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The Bureau assumes no responsibility with regard to the opinions and the results of experiments outlined in the Bulletin.

The Editor's notes are marked (Ed.).

THE INTERNATIONAL MOVEMENT OF FERTILIZERS.

No. 1.

September 1, 1914.

SUMMARY. — Introduction (p. 1101). — World's production of fertilizers (p. 1103). — International trade in fertilizers (p. 1109). — Consumption of fertilizers in different countries (p. 1124). — Prices of mineral phosphates, potash salts and nitrogenous fertilizers (p. 1132). — Bibliography (p. 1138).

INTRODUCTION.

This review is the first number of a half-yearly periodical whose publication was decided upon at the last General Assembly held at the Institute (Inst. int. d'agr., 4^{ème} Ass. gén., Décis. II, Rapport Pioda-Laur, 1913). The general plan of the review was established by the Permanent Committee; it will appear regularly in the official (French) edition on March 1st and September 1st, that is to say at those times of year when purchases are being made by consumers, and will form a continuation to *Production et consommation des engrais chimiques dans le monde*, already published by this Institute.

As regards the products to be considered, the scheme laid down in the above publication has been adhered to and the fertilizers limited to the following categories :

1. *Phosphatic fertilizers* : mineral phosphates, basic slag, superphosphates, guanos, bones.
2. *Potassic fertilizers* : Stassfurt salts, other potassic fertilizers.
3. *Nitrogenous fertilizers* : nitrate of soda, sulphate of ammonia, synthetic fertilizers, organic fertilizers.

In consideration of the similarity of their market conditions, sulphur and copper sulphate have been included in the Review as other products useful to agriculture.

The Review comprises five parts: production, imports and exports, consumption, prices, bibliography.

The figures given refer as far as possible to the whole year 1913 and to the first half-year of 1914; those referring to 1912 have also been reproduced for comparison. Prices are those of the first half of 1914 and of forward deliveries for the end of 1914 (1). The next number of the review, to appear on March 1, 1915, will contain final figures for 1913, and as far as possible all those for 1914, while prices will refer to the second half of 1914 and of forward deliveries for the beginning of 1915.

Production. — Each fertilizer forming a different category is tabulated according to its production in the different countries.

Imports and exports. — The principal products which are classified under separate headings in official returns are each tabulated to show the commercial movement in the different countries; an official statement of the international situation is thus obtained.

Consumption. — A few figures obtained by the Institute will be published under this heading; statistical information on this point is very difficult to obtain and should form the object of future development.

Prices. — Wholesale market prices from certain important markets are selected for reproduction and where necessary a distinction will be drawn between nominal quotations and actual selling price. This part of the Review will be further developed as time goes on in order that it should prove of the greatest possible practical value.

Prices of mineral phosphates are given both in America and c. i. f. in Europe. Potash salts are quoted at the German official prices and at New York, the latter as representative of the most important independent market.

Official quotations from the principal markets are compared for nitrate of soda, sulphate of ammonia and synthetic manures during the first six months of 1914, the figures referring to prices at the end of each month.

Bibliography. — Discoveries of new beds or the adoption of new manufacturing processes for dealing with chemical products used in agriculture will be notified in this part of the Review, as well as new methods of applying such products or legislative measures in connection with them.

(1) Quotations for forward deliveries have become invalid owing to the present international situation.

WORLD'S PRODUCTION OF FERTILIZERS AND OF CHEMICAL SUBSTANCES FOR AGRICULTURAL USE.

Phosphatic Fertilizers.

I. — WORLD'S PRODUCTION OF NATURAL PHOSPHATES.

Country	1912	1913	1st half-year 1914
	metric tons (1)	metric tons	metric tons
<i>a) Phosphorites:</i>			
United States of America.....	3 231 636	3 202 636	.....
Tunis	2 057 498	2 284 678	.....
Algeria	377 601	438 601	239 690
France	330 000	335 000	.....
Christmas Island	159 512	152 405	.....
Ocean and Nauru Islands.....	300 000	.....	.....
Belgium	203 100	.....	.....
Egypt.....	69 958	64 138	.....
Angaur (Palau Islands).....	60 000	90 000	60 000
Makatea (Tuamotu Islands).....	40 000	.....	.....
Dutch West Indies.....	20 362	.....	.....
Russia	25 000	25 000	.....
South Australia.....	6 198	.....	.....
French Guiana.....	.....	.....	.....
Spain .....	.....	.....	.....
Japan.....	7 879	8 000	.....
<i>b) Apatites:</i>			
Sweden .....	.....	.....	.....
Norway .....	.....	.....	.....
Canada	164	.....	.....
Total.....	6 888 908	(6 600 458)	.....

The figures for the United States refer to amounts mined; amounts sold were 3 146 573 m. tons in 1912 and 3 020 905 m. tons in 1913. The figures for Tunis also refer to amounts mined, while amounts despatched were 1 923 007 m. tons in 1912 and 1 984 880 m. tons in 1913. The figures for Algeria on the other hand refer to exports and should be increased by the amount consumed internally for the manufacture of superphosphate, which is in part exported (see Part 2, table III, p. 1111).

(1) Metric ton = 0.9931 long ton.

II. — WORLD'S PRODUCTION OF BASIS SLAG.

Country	1912	1913	1st half-year 1914
	metric tons	metric tons	metric tons
Germany.....	2 110 000	(2 200 000)	.....
France.....	679 000	(700 000)	.....
Belgium.....	534 000	(500 000)	.....
United Kingdom.....	400 000	404 000	.....
Luxemburg.....	253 000	(250 000)	.....
Austria-Hungary.....	92 000	(100 000)	.....
Italy.....	20 000	20 000	.....
Russia.....	16 000	32 000	.....
Sweden.....	15 000	(15 000)	.....
Other countries.....	(25 000)	(25 000)	.....
Total...	4 144 000	(4 246 000)	.....

Potassic Fertilizers.

With regard to the Stassfurt potash salts, figures are given which have been supplied by the German Potash Syndicate and it should be noted that these differ slightly from those published later by the German Imperial Office of Statistics (see *Vierteljahrshefte zur Statistik des Deutschen Reichs*).

III. — PRODUCTION OF POTASH SALTS IN GERMANY.

Nature of salts	1912	1913	1st half-year 1914
	metric tons	metric tons	metric tons
a) <i>Crude salts</i> :			
Carnallite and kieserite.....	5 281 642.7	5 302 350.5	.....
Kainite (including hartsalz and schoenite) and sylvinit.....	5 788 371.6	6 305 160.0	.....
Total.....	11 070 014.3	11 607 510.5	.....
b) <i>Treated salts</i> :			
Chloride of potash 80 %	471 434.6	484 254.1	.....
Sulphate of potash 90 %	115 728.4	110 783.6	.....
Sulphate of potash-magnesia calcined 48 %	55 987.2	58 269.1	.....
Potash manure salts 20, 30, 40 %	723 257.4	906 212.4	.....
Potash manure salts 38 %	48 059.0	50 393.4	.....
Sulphate of potash-magnesia, crystal- lised 40 %	172.5	119.4	.....
Kieserite in lumps.....	45 492.4	36 708.2	.....
Kieserite, calcined and ground.....	1 070.3	1 165.8	.....
Total.....	1 461 201.8	1 647 906.0	.....

IV. — TOTAL AMOUNTS OF POTASH SALTS SOLD FOR
AGRICULTURAL AND INDUSTRIAL PURPOSES (as K_2O).

Destination	1912	1913	1st half-year 1914
	metric tons	metric tons	metric tons
a) <i>For agricultural purposes</i> :			
Germany.....	463 383.6	536 102.6	.....
Other countries.....	440 375.4	467 810.6	.....
Total.....	903 759.0	1 003 913.2	.....
b) <i>For industrial purposes</i> :			
Germany.....	65 181.4	68 180.2	.....
Other countries	40 278.3	38 276.0	.....
Total.....	105 459.7	106 456.2	.....
Grand total.....	1 009 218.7	1 110 369.4	.....

Nitrogenous Fertilizers.

V. — GENERAL MOVEMENT OF CHILEAN NITRATE.

Movement	1912	1913	1st half-year (up to May 31) 1914
	metric tons	metric tons	metric tons
Production	2 773 459	2 586 975	1 214 747
Export.....	2 739 530	2 494 166	1 016 629
Consignments for consumption	2 556 973	2 530 645	1 765 319
Visible stocks (Dec. 31)	1 765 867	1 620 056	1 205 420 (May 31)

VI. — WORLD'S PRODUCTION OF SULPHATE OF AMMONIA.

Country	1912	1913	1st half-year 1914
	metric tons	metric tons	metric tons
Germany	492 000	549 000	.....
United Kingdom.....	394 500	425 700	.....
United States	149 700	176 900	.....
France	69 000	75 000	.....
Belgium.....	43 700	48 600	.....
Austria-Hungary	35 500	39 000	.....
Italy	11 100	15 000	2 200
Spain	12 000	15 000	.....
Netherlands.....	6 000	6 000	.....
Russia.....	4 000	8 000	.....
Japan	7 300	8 000	.....
Australia.....	3 000	3 000	.....
Denmark	2 400	2 800	.....
Sweden	1 400	1 400	.....
Other countries.....	(75 000)	(75 000)	.....
Total.....	(1 306 600)	(1 448 400)	.....

The figures for the United Kingdom refer to the total amount of ammonia produced stated as sulphate; according to the Board of Trade the sulphate of ammonia actually produced would only be a little over 84.34 per cent. of these figures. The amount of ammonia produced in Italy in the first half-year of 1914 refers only to sulphate formed by the conversion of calcium cyanamide.

VII. — WORLD'S PRODUCTION OF CALCIUM CYANAMIDE.

Country	1912	1913	1st half-year 1914
	metric tons	metric tons	metric tons
Germany.....	(25 000)	(25 000)	.....
Austria-Hungary.....	5 000	(7 500)	.....
United States and Canada.....	(14 000)	(14 000)	.....
France.....	(7 500)	(7 500)	.....
Italy.....	10 304	14 982	12 000
Japan.....	5 199	(7 500)	.....
Norway.....	13 892	22 111	.....
Sweden.....	6 043	(8 000)	.....
Switzerland.....	(7 500)	(7 500)	.....
Total.....	(94 438)	(114 093)	.....

Figures in brackets represent the productive capacity of the factories; others represent the actual production.

VIII. — MOVEMENT OF NORWEGIAN NITRATE OF LIME.

	1912	1913	1st half-year 1914
	metric tons	metric tons	metric tons
Estimated production.....	.....	70 000	35 000
Exports.....	51 701	70 171	.....

Other Chemical Products for Agricultural Use.

IX. — WORLD'S PRODUCTION OF CRUDE SULPHUR.

Country	1912	1913	1st half-year 1914
	metric tons	metric tons	metric tons
Sicily	356 531	345 349	159 243
	10 000	10 000	.....
Other Italian regions	37 497	37 839	.....
Italy..... (total)	404 028	393 188	.....
United States.....	308 328	316 575	.....
Japan	54 256	49 131	.....
Other countries.....	(50 000)	(50 000)	.....
Total...	816 612	808 894	.....

According to information from the " Consorzio solferino siciliano " the production in Sicily is made up of the amounts conveyed to exporting ports together with the internal consumption, which is estimated as 10 000 metric tons.

X. — WORLD'S PRODUCTION OF SULPHATE OF COPPER.

Country	1912	1913	1st half-year 1914
	metric tons	metric tons	metric tons
United Kingdom.....	85 500	76 843	63 261
Italy.....	52 312	29 217	.....
United States	17 908	24 643	.....
France.....	26 000	26 000	.....
Austria-Hungary.....	15 200	15 400	.....
Germany	5 942	5 682	.....
Other countries (Sweden, etc.).....	1 000	1 000	.....
Total...	203 862	178 785	.....

The figures given for the United Kingdom are those of exports, which are approximately equal to the production. For Ireland the following figures have been obtained :

	Imports		Exports	
1912.....	2 899	metric tons	14.2	metric tons
1913.....	4 780	"	3	"

INTERNATIONAL TRADE.

The data given below are drawn from the customs returns of imports and exports for each country and represent what is commonly termed the special trade of imports and exports (see: Inst. Int. d'Agr., Publications du Bureau de la Statistique Générale, No. 4, *Notes sur les Statistiques du Commerce extérieur dans les différents pays*, 1914). The figures referring to similar or almost similar classes of material in the returns have been collected into tables with various headings, qualifying notes being made where necessary.

The fiscal year in Canada ending in March, the figures for the two years ending in March 1913 and 1914 are given under 1912 and 1913 respectively. The same applies to British India.

Phosphatic Manures.

I. — IMPORTS AND EXPORTS OF NATURAL PHOSPHATES.

Country	Imports			Exports		
	1912	1913	1st half-year 1914	1912	1913	1st half-year 1914
	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons
Germany	902 824	928 798	420 165	7 032	6 885	732
Austria-Hungary	175 831	212 003	128 180	.....	.....	.....
Belgium	244 221	244 765	113 668	22 916	18 158	10 988
Denmark	45 710	55 875	.....	.....	.....	.....
Egypt .....	.....	.....	.....	52 115	64 183	.....
Spain	176 183	254 463	.....	.....	.....	.....
United States .....	.....	.....	.....	1 225 824	1 388 362	.....
France	907 845	934 679	472 554	22 062	21 128	7 997
Algeria .....	.....	.....	.....	377 601	438 601	239 690
Tunis	1 910 198	.....	.....	.....	.....	.....
Great Britain	528 591	547 640	279 544	4 492	11 808	26 466
Ireland .....	.....	162 599	.....	.....	943	.....
Australia .....	.....	8 406	.....	.....	190	.....
Canada	12 509	691	.....	.....	.....	.....
Union of South Africa .....	.....	.....	.....	.....	.....	.....
Italy	466 144	529 776	.....	1 285	4 171	.....
Japan	286 984	333 916	.....	.....	.....	.....
Norway .....	.....	.....	.....	1	.....	.....
Netherlands	60 161	.....	.....	5 708	.....	.....
Russia	47 421	.....	.....	.....	.....	.....
Sweden	81 574	110 450	.....	.....	.....	.....
Switzerland	17 821	18 885	.....	.....	.....	.....

II. — IMPORTS AND EXPORTS OF BASIC SLAG.

Country	Imports			Exports		
	1912	1913	1st half-year 1914	1912	1913	1st half-year 1914
	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons
Germany	372 835	441 069	234 681	663 024	713 878	307 106
Austria-Hungary....	203 536	212 788	110 153	3 607	2 007	950
Belgium	130 439	144 553	76 248	550 847	685 907	335 016
Denmark	9 948	8 957	.....	.....	.....	.....
France	59 870	41 010	17 933	248 810	246 271	95 762
	—	—	663 643	—	—	2 312 643
Great Britain	50 102	51 951	13 450	159 689	167 742	70 249
Ireland	50 102	51 951	13 450	159 689	167 742	70 249
Canada.....fr.	47 899	33 042	.....	.....	.....	.....
Union of South Africa .....	.....	5 416	.....	.....	.....	.....
Italy.....	118 190	119 257	4 727	14	103	.....
Japan	245	17	.....	.....	.....	.....
Norway	40 257	34 492	.....	.....	.....	.....
Netherlands	339 968	.....	.....	154 483	.....	.....
Russia.....	170 340	.....	.....	.....	.....	.....
Sweden	21 047	19 243	.....	.....	.....	.....
Switzerland	54 182	55 793	.....	.....	.....	.....

The first set of figures for France are those given under the heading of "machefer" in the returns; when ground, the same material was entered under the heading "engrais chimique" till the end of 1913, so that the figures only referred to a portion of the trade in slag; for the first half of 1914 the imports and exports of ground slag are given separately in the second set of figures.

III. — IMPORTS AND EXPORTS OF SUPERPHOSPHATE.

Country	Imports			Exports		
	1912	1913	1st half-year 1914	1912	1913	1st half-year 1914
	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons
Germany.....	62 399	53 193	29 225	271 349	282 653	192 145
Austria-Hungary....	79 531	75 224	43 993	5 354	3 748	1 971
Belgium.....	37 802	28 012	31 435	314 713	318 922	171 390
Denmark.....	102 135	110 155	.....	.....	.....	.....
Egypt.....	11 459	13 148	.....	.....	.....	.....
Spain.....	161 047	149 602	.....	.....	.....	.....
France.....	89 059	100 822	55 768	169 617	145 236	72 001
Algeria.....	28 183	18 164	1 284	3 329	8 006	.....
Great Britain.....	.....	.....	.....	90 314	64 496	28 534
Ireland.....	.....	.....	.....	.....	.....	.....
Australia.....	.....	27 138	.....	.....	120 881	.....
Canada.....	878	966	.....	.....	.....	.....
Union of South Africa.....	.....	37 207	.....	.....	.....	.....
Japan.....	254	977	.....	25 705	16 885	.....
Mexico.....	.....	60	.....	.....	.....	.....
Norway.....	8 543	4 283	.....	.....	.....	.....
Netherlands.....	295 613	.....	.....	346 186	.....	.....
Russia.....	188 244	.....	.....	.....	.....	.....
Sweden.....	9 815	.....	.....	57 807	36 037	.....

In many countries, such as Italy and certain colonies, where the use of fertilizers is still very limited, superphosphate is included under the general heading of "chemical fertilizers" in the returns and therefore does not appear in the above table.

IV. — IMPORTS AND EXPORTS OF GUANO.

Country	Imports			Exports		
	1912	1913	1st half-year 1914	1912	1913	1st half-year 1914
	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons
Germany.....	28 659	35 299	14 283	844	136	182
	18 509	26 620	4 886	6 140	5 691	3 138
Argentine Republic.....				24 078	28 630	
Belgium.....	15 166	49 541	11 099	31 697	29 446	14 979
Chile.....	509					
Spain.....	2 486	1 781				
United States.....	19 467	19 411				
France.....	311	1 376		403	317	
Great Britain.....	14 341	25 957	14 857			
Ireland.....						
Australia.....		1 362			317	
Canada.....	1 896	3 289				
British India.....	13	93		18 650	21 750	
New Zealand.....	13 574					
Union of South Africa.....		318				
Italy.....	195	111	12			
Norway.....				10 693	13 063	
Netherlands.....	13 890	22 317		11 046	10 968	
Sweden.....	187			454		
Switzerland.....	112	72				

The first set of figures for Germany refer to natural guano, the second to artificial guano and similar products. The exports from the Argentine consist of meat guano, while those from British India, Norway and the greater part from Sweden are fish guano. South Africa, over and above its official imports, received 6 993 and 4 830 metric tons of guano from the coastal islands during 1913 and the first half of 1914 respectively.

V. — IMPORTS AND EXPORTS OF BONES AND BONE MANURES.

Country	Imports			Exports		
	1912	1913	1st half-year 1914	1912	1913	1st half-year 1914
	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons
Germany.....	16 343	24 481	13 731	7 870	6 514	3 219
	36 842	30 845	11 035	28 925	32 474	19 335
Argentine Republic.....				30 451	30 716	
				1 427	895	
Austria-Hungary.....	13 336	7 080		10 193	9 582	
Belgium.....	41 656	45 509	21 110	16 365	22 748	18 844
				1 730		
Chile.....				38		
China.....				29 976		
Denmark.....	120			34		
Turkey.....	28			4 794		
Egypt.....				4 310	3 747	
United States.....	34 703	35 173				
	38 095	36 768	22 444	10 973		10 152
France.....	892	2 627	381	977	499	476
Algeria.....				1 656	1 774	
Great Britain.....						
Ireland.....	41 862	41 336	20 002			
Australia.....					4 384	
	1 204	2 207		9	3 311	
Canada.....	3 839	3 890				
British India.....	52			111 984	107 100	
				21		
New Zealand.....	10 677			13		
Union of South Africa.....		4 276				
Greece.....				300		
Italy.....	4 193	5 630	2 115	3 630	7 028	3 642
Japan.....	39 302	47 894				
Norway.....				863	1 217	
Russia.....	1 230					
Servia.....	78			478		
Sweden.....	4 475			283		
				4 527		
Uruguay.....				5 755		

Where two sets of figures are given for any country, the first set refer to raw bones and the second to treated bones, such as bone flour, bone ash, calcined bones.

Potassic Fertilizers.

VI. — IMPORTS AND EXPORTS OF POTASH SALTS.

Country	Imports			Exports		
	1912	1913	1st half-year 1914	1912	1913	1st half-year 1914
	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons
Germany	a —	—	—	1 300 459	1 676 156	727 042
	b 43	44	52	85 479	133 358	50 061
	c 46	15	30	286 614	393 320	159 348
Austria-Hungary	a 97 721	110 069	54 330	1 572	1 774	1 155
	b 13	19	6	800	1 474	845
	c 5 280	5 216	1 889	855	1 317	697
Chile	a 49	—	—	—	—	—
Denmark	a 25 887	24 667	—	—	—	—
United States	a 694 133	600 168	—	—	—	—
	b 44 071	40 172	—	—	—	—
	c 218 751	217 191	11 335	620	708	448
France	b 17 805	11 284	30 006	271	134	61
	c 45 174	46 137	—	—	—	—
Ireland	a 19 313	17 781	—	—	—	—
	b 442	414	—	—	—	—
	c 1 204	1 173	—	—	—	—
Canada	a 19	180	—	—	—	—
	b 4 781	6 957	—	—	—	—
Union of South Africa	a —	1 812	—	—	—	—
Greece	c 276	—	—	—	—	—
Italy	b 13 466	9 839	2 059	2.5	0.7	—
	c 8 153	7 154	3 246	0.1	—	0.5
Japan	a 81	—	50	—	—	—
Mexico	b —	10	50	—	—	—
	c —	81	—	—	—	—
Norway	a 21 304	21 084	—	—	—	—
Russia	a 83 131	—	—	—	—	—
	c 5 995	—	—	—	—	—
Sweden	a 85 776	80 253	—	—	—	—
Switzerland	a 15 006	13 241	—	—	—	—
	c 1 572	1 572	—	—	—	—

The sets of figures classified as *a* refer to substances designated as "potash manure salts"; those under *b* to substances designated as "sulphate of potash"; those under *c* to substances designated as "muriate of potash". This classification is not, however, always very exact; for example in Italy kainite and other manure salts are included under *b*. The exports for Germany for 1913 are rather high, as they include a part of those for 1912.

The only potassic fertilizer classified separately in the United Kingdom is nitrate of potash (see Part 2, Table VIII, p. 1116) the rest are returned under the heading of unenumerated manures.

VII. — IMPORTS AND EXPORTS OF OTHER POTASH MANURES.

Country	Imports			Exports		
	1912	1913	1st half-year 1914	1912	1913	1st half-year 1914
	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons
Germany.....	597	402	276	14 450	16 058	7 551
Chili.....	86					
China.....	3 886					
France.....	53	71	291	952	708	412
	1 293	3 597	1 400	3 719	1 586	1 559
Great Britain.....	11 034	12 084	6 273	1 935	1 723	74
Ireland.....						
Canada.....	840	938				
(barrels)				550	434	
British India.....	3			15 076	13 618	
New Zealand.....	998					
Greece.....	2 576					
Italy.....	461	458	209	3	6	
Japan.....		10				
	418	522				
Norway.....				1 784	2 521	
				32 844	32 796	
				7 000	53 047	
Netherlands.....	4 312	6 721		7 407	6 243	
Servia.....	352					
Sweden.....				34 643	37 655	

The product referred to in this table is nitrate of potash except in the following cases :

1. The second set of figures for France, which refer to beet potash.

2. The second set of figures for Canada which refer to wood ashes.

3. " " " " " Norway " " kelp ash.

4. The third " " " " " " " felspar.

5. The fourth " " " " " " " ground felspar.

6. The single " " " " Sweden " " felspar.

Nitrogenous Manures.

VIII. — IMPORTS AND EXPORTS OF NITRATE OF SODA.

Country	Imports			Exports		
	1912	1913	1st half-year 1914	1912	1913	1st half-year 1914
	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons
Germany	812 898	774 299	589 854	27 431	27 557	23 324
Argentine Republic...	373	649	.....	.....	.....	.....
Austria-Hungary.....	92 838	93 025	62 733	403	313	580
Belgium.....	235 382	304 136	164 598	122 668	13 999	88 195
Chile.....	.....	.....	.....	2 498 529	.....	.....
Denmark.....	36 402	35 024	.....	.....	.....	.....
Egypt.....	56 047	56 474	.....	.....	.....	.....
Spain.....	46 715	35 557	.....	.....	.....	.....
United States.....	444 134	635 876	.....	.....	.....	.....
France.....	353 776	322 115	232 813	10 233	5 268	1 879
Great Britain.....	125 557	143 181	66 822	.....	.....	.....
Ireland.....	.....	.....	.....	.....	.....	.....
Australia .....	.....	3 393	.....	.....	516	.....
Canada	39 714	36 406	.....	.....	.....	.....
Union of South Africa .....	.....	66	.....	.....	.....	.....
Italy.....	54 654	67 418	58 405	27	50	170
Japan.....	85 271	112 405	.....	.....	.....	.....
Norway.....	1 130	1 337	.....	184	811	.....
Netherlands.....	204 169	202 928	.....	129 763	121 096	.....
Russia	50 630	.....	.....	.....	.....	.....
Servia.....	135	.....	.....	.....	.....	.....
Sweden.....	35 107	33 892	.....	.....	.....	.....
Switzerland.....	3 162	3 328	.....	37	29	.....

The official figures given above do not agree with those published by the Nitrate Association, which are based on commercial data and therefore do not represent exactly exports and imports (see Bertrand, A., Circular No. 60 de la Asociacion Salitrera, p. 206).

For many countries no figures can be given as special returns for nitrate are not made, or are published with too great a delay.

IX. — IMPORTS AND EXPORTS OF SULPHATE OF AMMONIA.

Country	Imports			Exports		
	1912	1913	1st half-year 1914	1912	1913	1st half-year 1914
	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons
Germany.....	23 098	34 627	22 528	57 267	75 868	74 723
Austria-Hungary	21	51	28	20 818	23 816	20 210
Belgium.....	20 062	24 199	22 976	17 886	41 382	17 239
Denmark				2 415	2 329	
Egypt	651	1 650				
United States.....	54 015	59 670				
France.....	22 892	22 995	7 764	1 976	1 151	827
Great Britain.....				289 512	328 223	167 075
Ireland						
Australia.....		792			2 340	
Canada	219	159				
Union of South Africa.....		362				
Italy.....	21 190	21 669	8 253	4	55	8
Japan	93 416	26 938				
Mexico.....		63	19			
Norway.....				175	138	
Netherlands	39 275			31 317		
Serbia	76	136	52			
Sweden	46			41		

This table is incomplete, especially with regard to imports in the colonies. Such data may be found in the export returns of the United Kingdom, Belgium (Antwerp), Netherlands (Rotterdam), and now also in those of Germany which has started a considerable export trade to Italy, the Dutch Indies, etc. (see Inst. Int. d'Agr. *Production et Consommation des Engrais Chimiques dans le Monde*).

X. — IMPORTS AND EXPORTS OF SYNTHETIC NITROGENOUS FERTILIZERS.

Country	Imports			Exports		
	1912	1913	1st half-year 1914	1912	1913	1st half-year 1914
	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons
Germany	44 612	54 378	31 038	8 134	30 466	22 440
Denmark	412	5 066				
Egypt	728	971				
United States	2 339					
France	3 160	10 010	1 531	789	839	320
Algeria	766	1 091	458			
Canada	737	1 167				
Mexico			2.5			
Norway				4 270	7 807	
				51 701	70 171	
				13 892	22 111	
Sweden	8					
	176			0.4		
	0.2			4 058		

The imports of Egypt consist only of calcium cyanamide, those of the United States only of nitrate of lime and those of Canada only of nitrate of ammonia, but the latter are probably not put to agricultural use.

The first, second and third sets of figures for Norway and Sweden refer to nitrate of ammonia, nitrate of lime and calcium cyanamide respectively. Figures for the exports of Norway during the first quarter of 1914 are as follows:

2 771 metric tons of nitrate of ammonia
 19 636 " " " " " lime
 9 838 " " " " " calcium cyanamide.

XI. — EXPORTS AND IMPORTS OF ORGANIC NITROGENOUS FERTILIZERS.

Country	Imports			Exports		
	1912	1913	1st half-year 1914	1912	1913	1st half-year 1914
	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons
Germany	3 261	2 899	1 373	5 307	6 704	3 941
	57 930	64 421	35 636	12 022	15 781	9 866
Argentine Republic...				13 858	12 782	
Austria-Hungary ...	893	560	217	3 647	3 444	1 589
	1 237	1 667	963	777	654	388
China	140 307			51 066		
				493 477		
Egypt					75	
				80 778	62 977	
France	72 573	82 072	33 835	31 365	30 728	15 079
British India	19	464		164 380	178 126	
Japan	623 471	373 800				
Norway				14 548	8 929	
Switzerland	145	136		652	1 626	
	2 190	2 053		1 354	1 579	
Uruguay				137 559		

The first set of figures for Germany, Austria-Hungary and Switzerland refer exclusively to horns and hoofs for manurial use; the second set refer to other animal residues, blood, etc. The figures for the Argentine Republic and Uruguay represent the total slaughterhouse residues excluding meat guanós and bones, which are given elsewhere.

The exports and imports for China, Egypt and India consist entirely of oil cakes with the exception of a small export of other material from Egypt shown in the first figure for 1913. Soya bean exports from China are classified separately in the second set of figures for 1912. It should be noted that oil cakes are largely but by no means exclusively used for manure in India.

Other Fertilizers and Chemical Products used in Agriculture.

XII. — IMPORTS AND EXPORTS OF UNENUMERATED CHEMICAL FERTILIZERS.

Country	Imports			Exports		
	1912	1913	1st half-year 1914	1912	1913	1st half-year 1914
	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons
Argentine Republic..	381	546	.....	.....	.....	.....
Chile	52	.....	.....	.....	.....	.....
China	49 647	.....	.....	.....	.....	.....
Egypt	61	245	.....	.....	.....	.....
United States.....	.....	.....	.....	75 780	73 911	.....
France.....	147 495	223 217	66 364	306 975	403 305	7 971
Algeria.....	9 493	10 291	.....	.....	.....	.....
Australia.....	.....	10 784	.....	.....	.....	.....
Canada, fr.	279 806	312 060	.....	.....	.....	.....
British India.....	54 864	.....	.....	.....	.....	.....
Italy.....	37 032	71 729	15 372	9 243	19 310	14 094
Mexico .....	.....	80	75	.....	.....	.....
Serbia.....	18	.....	.....	.....	.....	.....
Switzerland.....	25 926	26 309	.....	7 487	10 994	.....

The nature of the products varies with the different countries. In France, up to 1914, they included ground basic slag. In Italy the greater part of the superphosphate is included. In the United States the figures refer almost exclusively to compound manures exported more especially to other countries on the American continent (Canada, Mexico, etc.).

XIII. — IMPORTS AND EXPORTS OF OTHER UNCLASSIFIED MANURES.

Country	Imports			Exports		
	1912	1913	1st half-year 1914	1912	1913	1st half-year 1914
	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons
Belgium.....	42 085	43 038	18 326	54 414	56 868	23 039
Turkey	287	.....	.....	14 721	.....	.....
Spain.....	90 684	91 380	.....	14 143	24 869	.....
Great Britain.....	170 592	175 643	91 217	135 224	154 876	79 437
Ireland.....	.....	.....	.....	.....	.....	.....
Australia .....	.....	.....	.....	.....	12 077	.....
British India.....	288	.....	.....	8 471	.....	.....
New Zealand	78 782	.....	.....	112	.....	.....
Union of South Africa.....	.....	7 788	.....	.....	.....	.....
Greece	656	.....	.....	.....	.....	.....
Italy.....	19 640	12 651	10 416	19 977	28 670	1 692
Japan	85 914	134 397	.....	36 628	27 391	.....
Norway	1 958	1 172	.....	.....	.....	.....
Netherlands.....	1 579 332	1 635 566	.....	109 497	62 215	.....
Russia.....	15 168	.....	.....	.....	.....	.....

This last class of manures is still more heterogenous. In Great Britain and Spain it includes potash salts, while the Netherlands include all fertilizers except guano and nitrate of soda under the one heading in their monthly returns, though further classifications occur in their annual returns. In Italy the figures refer exclusively to organic manures amongst which olive and wine pomace have recently assumed some importance.

XIV. — IMPORTS AND EXPORTS OF SULPHUR.

Country	Imports			Exports		
	1912	1913	1st half-year 1914	1912	1913	1st half-year 1914
	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons
Germany.....	42 284	46 737	29 772	1 746	3 472	2 653
Argentine Republic ..	4 549	3 125	.....	.....	.....	.....
Austria-Hungary	41 023	39 442	23 781	1 048	312	59
Belgium	15 647	11 724	4 193	10 498	6 745	4 399
China	1 322	.....	.....	.....	.....	.....
Denmark .....	.....	268	.....	.....	.....	.....
Turkey	4 768	.....	.....	57	.....	.....
Egypt	643	600	.....	.....	.....	.....
Spain.....	6 565	11 202	.....	4	2	.....
United States	27 315	14 870	.....	5 865	9 065	.....
France.....	172 181	186 348	82 842	39 694	23 325	12 695
Algeria	26 105	31 991	30 013	.....	.....	.....
Great Britain.....	22 098	18 505	9 081	1 856	731	.....
Ireland .....	.....	.....	.....	.....	.....	.....
Canada	32 983	27 085	.....	.....	.....	.....
British India	5 841	6 428	.....	.....	.....	.....
New Zealand.....	2 034	.....	.....	.....	.....	.....
Greece	8 714	.....	.....	.....	.....	.....
Italy.....	184	183	74	351 339	376 387	194 451
Japan .....	.....	.....	.....	49 131	54 256	.....
Norway.....	13 911	14 607	.....	.....	.....	.....
Netherlands.....	35 324	36 937	.....	14 341	10 216	.....
Servia	71	.....	.....	.....	.....	.....
Switzerland	3 358	3 562	.....	.....	.....	.....
Sweden	38 471	38 192	.....	.....	.....	.....

Sulphur under all forms (crude or refined) is included in the above table. It is imported chiefly by the countries in which vine or fruit growing is specially well developed.

XV. — IMPORTS AND EXPORTS OF SULPHATE OF COPPER.

Country	Imports			Exports		
	1912	1913	1st half-year 1914	1912	1913	1st half-year 1914
	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons
Germany	7 074	3 864	4 448	3 812	4 012	3 533
Argentine Republic..	1 376	1 288	.....	.....	.....	.....
Austria-Hungary....	16 132	6 937	6 497	119	172	203
Chile.....	221	.....	.....	.....	.....	.....
Denmark.....	.....	249	.....	.....	.....	.....
Turkey	1 623	.....	.....	1.5	.....	.....
Spain	7 121	6 433	.....	1	2	.....
United States .....	.....	.....	.....	3 097	1 910	.....
France	16 801	21 575	21 734	6 904	5 312	5 377
Algeria	4 612	3 609	3 687	.....	.....	.....
Great Britain.....	.....	.....	.....	84 124	76 843	63 261
Ireland .....	.....	.....	.....	.....	.....	.....
Canada	1 152	605	.....	.....	.....	.....
Greece	2 524	.....	.....	.....	.....	.....
Italy	36 568	30 450	21 491	1 387	522	1 504
Servia.....	883	.....	.....	.....	.....	.....
Switzerland	2 873	2 103	.....	66	62	.....
Sweden .....	.....	.....	.....	513	250	.....

The international trade in sulphate of copper is becoming important; this product, like sulphur, is chiefly imported by those countries having large areas under fruit and vines.

THE CONSUMPTION OF FERTILIZERS IN THE DIFFERENT COUNTRIES.

I. — MOVEMENT IN DENMARK DURING 1913 OF FERTILIZERS AND OTHER CHEMICAL PRODUCTS FOR AGRICULTURAL USE.

Fertilizers	Imports	Exports	Consumption
	metric tons	metric tons	metric tons
<i>Phosphatic fertilizers.</i>			
Mineral phosphates.....	55 875	.....	55 875
Superphosphate	110 151	683	.....
Basic slag	8 944	.....	8 944
Bone flour.....	282	2	.....
<i>Nitrogenous fertilizers.</i>			
Synthetic products	5 066	.....	5 066
Nitrate of soda.....	34 930	.....	34 930
Sulphate of ammonia.....	524	2 830	.....
<i>Potassic fertilizers.</i>			
Kainite.....	9 400	.....	9 400
Others	16 700	.....	16 700
 Lime, in lumps.....	 5 079	 2 085	.....
Lime, ground.....	1 411	3 357	.....
Marl.....	9 021	.....	.....
 Manures from animal sources.....	 85	 105	.....
Sulphate of copper.....	249	.....	249
Sulphur.....	268	.....	268

The above data were collected by the Danish Office of the International Institute of Agriculture at Copenhagen.

II. — CONSUMPTION OF FERTILIZERS IN THE UNITED STATES DURING THE YEARS 1911-1913.

State	End of fiscal year	1911	1912	1913
		metric tons	metric tons	metric tons
Alabama.....	Oct. 1.....	399 161	410 243	430 668
*Arizona.....	—.....	317	454	544
*Arkansas.....	Dec. 31.....	36 287	45 359	47 174
California.....	June 30.....	45 087	45 359	32 659
*Colorado.....	—.....	2 268	2 722	3 175
*Connecticut.....	April 30.....	40 823	43 545	45 359
*Delaware.....	Dec. 31.....	22 680	27 215	45 359
Florida.....	».....	166 411	170 485	193 891
Georgia.....	Sept. 30.....	1 091 091	1 001 409	1 016 676
*Idaho.....	—.....	907	1 361	1 814
*Illinois.....	April 30.....	72 575	77 111	81 647
Indiana.....	Oct. 15.....	163 147	130 342	175 902
*Iowa.....	April 30.....	1 814	2 268	3 175
Kansas.....	Dec. 31.....	1 361	4 530	6 695
Kentucky.....	».....	58 967	58 967	68 039
Louisiana.....	Aug. 31.....	82 631	68 542	89 610
*Maine.....	Dec. 31.....	127 006	136 078	145 150
Maryland.....	».....	143 335	145 150	153 314
Massachusetts.....	».....	65 317	68 039	113 398
Michigan.....	».....	40 823	46 266	52 603
*Minnesota.....	».....	1 814	2 177	3 175
Mississippi.....	Oct. 1.....	134 478	108 599	116 165
Missouri.....	Dec. 31.....	37 816	34 799	54 431
Montana.....	—.....	544	635	726
*Nebraska.....	—.....	272	454	907
*Nevada.....	—.....	454	544	726
*New Hampshire.....	April 30.....	17 230	19 958	22 680
New Jersey.....	Oct. 31.....	122 470	127 006	142 120
*New Mexico.....	—.....	726	816	907
*New York.....	Dec. 31.....	362 874	385 554	417 305
North Carolina.....	».....	645 353	631 133	762 441
*North Dakota.....	».....	454	544	907
Ohio.....	».....	134 263	137 696	167 829
*Oklahoma.....	April 30.....	7 257	9 072	16 329
*Oregon.....	Aug. 31.....	2 722	3 175	4 082
Pennsylvania.....	Dec. 31.....	285 703	289 134	308 443
Porto Rico.....	June 30.....	20 865	18 144	17 088
*Rhode Island.....	March 31.....	10 886	13 608	16 329
South Carolina.....	June 30.....	951 461	803 967	833 101
*South Dakota.....	July 1.....	181	272	635
Tennessee.....	June 1.....	58 967	70 282	76 258
Texas.....	Sept. 1.....	48 067	40 823	68 492
*Utah.....	Dec. 31.....	544	635	907
*Vermont.....	».....	18 144	19 958	22 680
Virginia.....	».....	326 101	337 571	374 154
*Washington.....	March 31.....	1 179	1 270	1 361
West Virginia.....	July 1.....	28 349	28 803	28 896
*Wisconsin.....	Dec. 31.....	2 268	3 175	3 629
*Wyoming.....	—.....	113	136	181
Total.....		5 783 636	5 575 392	6 169 736
Alaska.....	June 30.....		9	41
Hawaii.....	».....		63 500	60 000

* States in which there are no fertilizer laws.

The above figures are furnished by the Agricultural Experiment Stations in the various States ; in the States where there are no fertilizer laws (marked with an asterisk) the estimates are only approximative.

III. — IMPORTS OF MANURES INTO CEYLON DURING THE FISCAL YEAR 1912-1913 COMPARED WITH THOSE OF 1908.

Manure	1908			1912-13		
	Metric tons	Long tons	Price per long ton	Metric tons	Long tons	Price per long ton
			Rupees *			Rupees
Castor cake	7 082	6 971	56	4 257	4 190	88.8
Groundnut cake.....	—	—	—	15 877	15 627	87.1
Rape cake	—	—	—	1 510	1 486	40.5
Fish manure	74	73	57	21 058	20 726	57.0
Guano.....	10	10	120	3 720	3 661	98.0
Blood meal	—	—	—	2 653	2 611	171.0
Bone meal.....	4 789	4 714	55	6 750	6 644	83.5
Superphosphate	—	—	—	2 549	2 509	100.0
Basic slag	—	—	—	6 468	6 366	53.8
Sulphate of potash ..	55	54	166	5 163	5 082	145.0
Chloride of potash...	—	—	—	1 224	1 205	133.6
Kainit	—	—	—	1 651	1 625	51.6
Nitrate of potash ...	73	72	296	2 115	2 082	208.0
Refuse salt p. tre	292	287	200	—	—	—
Sulphate of ammonia	137	135	296	2 466	2 427	254.0
Nitrate of soda.....	—	—	—	278	274	182.0
Other manures.....	459	452	167	4 163	4 097	105
Total...	12 972	12 768		81 902	80 612	

* 1 rupee = rs 4d.

With a cultivated area of 2 800 000 acres (Statesman's Year-Book, 1914), the consumption of manure per acre is 54.5 lbs.

IV. — CONSUMPTION OF FERTILIZERS IN AUSTRALIA.

	Metric tons	Long tons
New South Wales (1912)	39 541	38 918
Victoria (1912)	95 514	94 010
Queensland (1913)	10 368	10 205
South Australia (1912)	93 073	91 607
Western Australia (1912)	48 324	47 563
Tasmania { (1912)	9 420	9 272
(1913)	8 890	8 750
Federal Territory (1912)	851	838
Northern Territory (1912)	1	1

The figures were received from the Department of Foreign Affairs, Commonwealth of Australia.

V. — CONSUMPTION OF FERTILIZERS IN JAPAN.

Manure	1911			1912		
	Metric tons	Long tons	Value in yen *	Metric tons	Long tons	Value in yen
Superphosphate	266 992	262 788	7 672 105	424 003	417 326	11 721 277
Guano	1 078	1 061	44 639	3 622	3 565	107 078
Bones	35 888	35 323	2 174 583	35 726	35 164	2 321 479
Potassic manures	1 089	1 072	64 498	1 331	1 310	72 168
Nitrate of soda	32 257	31 749	4 575 018	41 673	41 017	5 860 553
Sulphate of ammonia	11 383	11 204	1 126 376	7 737	7 615	798 720
Synthetic nitrogenous fertilizers	297	292	30 682	5 199	5 117	516 650
Compound manures	208 469	205 186	14 308 988	237 880	234 134	16 862 526
Other manures .....	.....	.....	1 089 225	.....	.....	2 405 835

* 1 yen = 25 0/100d.

The figures were furnished by the Japanese Ministry of Agriculture and Commerce.

VI. — WORLD'S CONSUMPTION OF POTASSIC FERTILIZERS FOR AGRICULTURAL PURPOSES (1).

Country	Potassic manures as K ₂ O in metric tons	
	1912	1913
Germany.....	463 383.6	536 102.6
Belgium.....	10 945.2	13 182.5
Netherlands.....	39 473.7	43 478.4
France.....	31 690.8	33 114.9
England.....	12 958.9	12 956.1
Scotland.....	7 182.9	7 150.8
Ireland.....	3 272.6	3 303.7
Luxemburg.....	284.0	401.9
Austria.....	18 873.4	20 974.3
Hungary.....	3 736.4	4 098.4
Switzerland.....	3 500.9	3 308.5
Italy.....	7 295.9	6 354.1
Russia.....	23 420.0	22 654.6
Spain.....	9 009.2	8 292.4
Portugal.....	1 134.4	1 241.2
Sweden.....	20 670.0	19 513.5
Norway.....	3 431.0	3 593.2
Denmark.....	6 006.0	7 477.6
Finland.....	1 422.4	1 605.6
Balkan States.....	371.1	198.3
EUROPE.....	668 062.4	749 002.6
British India.....	812.4	1 084.7
Ceylon.....	3 210.9	2 647.6
Straits Settlements.....	65.2	15.6
Java.....	355.2	153.7
Sumatra.....	413.4	411.5
Celebes.....	—	0.3
Indo-China.....	21.8	24.8
China.....	18.9	63.4
Japan.....	792.2	1 179.7
Philippine Islands.....	63.0	75.0
Turkistan.....	—	—
Asia M.nor, Palestine.....	70.9	54.0
ASIA.....	5 823.9	5 710.3
Marocco.....	—	—
Algeria.....	1 289.8	1 459.7
Tunis.....	40.5	38.1
Egypt.....	84.8	72.5
Carried forward.....	1 415.1	1 570.3

(1) Figures supplied by the German Potash Syndicate.

VI. — WORLD'S CONSUMPTION OF POTASSIC FERTILIZERS FOR AGRICULTURAL PURPOSES (*continued*).

Country	Potassic manures as K ₂ O in metric tons	
	1912	1913
Brought forward.....	1 415.1	1 570.3
Union of South Africa.....	456.9	1 018.1
German Colonies in Africa.....	230.1	285.8
Angola.....	1.3	0.2
French Congo.....	.....	.....
Belgian Congo.....	10.8	.....
Nigeria.....	.....	.....
Canary Islands.....	688.6	1 109.3
Azores.....	6.9	12.4
Madeira.....	67.9	118.5
Mauritius and Reunion.....	185.8	126.1
Seychelles.....	.....	.....
Fernando Po.....	.....	.....
S. Thomé and Príncipe Is.	77.6	129.4
AFRICA.....	3 141.0	4 370.1
United States.....	2 159 965.7	2 316 89.6
Canada.....	279.2	1 375.3
Mexico.....	108.7	91.3
Central America.....	243.4	278.5
West Indies.....	1 840.4	2 481.2
Hawaii.....	2 952.3	3 818.8
Brazil.....	1 104.5	1 270.9
Paraguay.....	.....	.....
Uruguay.....	13.2	20.1
Argentine Republic.....	21.1	33.3
Chile.....	210.5	202.7
Bolivia.....	.....	.....
Peru.....	1 315.8	1 004.3
Equador.....	.....	0.1
Colombia.....	17.5	4.3
Venezuela.....	0.1	.....
British Guiana.....	3.2	12.8
Dutch Guiana.....	.....	0.1
AMERICA.....	224 075.6	242 283.3
AUSTRALIA.....	2 621.1	2 490.4
POLYNESIA.....	35.0	56.5
TOTAL.....	903 759.0	1 003 913.2

VII. — WORLD'S CONSUMPTION OF NITRATE OF SODA. (I).

Country	1912	1913
	metric tons	metric tons
England.....	101 080.6	94 360.6
Scotland.....	36 333.9	34 200.9
Germany.....	911 952.2	833 112.5
France.....	354 517.4	327 191.8
Belgium.....	309 817.0	318 514.8
Netherlands.....	180 924.2	164 501.9
Italy.....	44 545.1	51 689.7
Austria-Hungary.....	7 113.5	7 444.9
Denmark.....	4 825.2	10 748.0
Switzerland.....	5 198.0	—
Spain.....	13 554.0	13 150.2
Egypt.....	23 981.0	25 637.7
United States.....	1 993 852.1	1 880 553.2
Other countries.....	441 047.0	589 186.7
Chile.....	93 376.9	84 020.8
	2 368.5	3 212.3
Total.....	2 530 644.5	2 556 971.0

VIII. — CONSUMPTION OF NITROGEN FOR AGRICULTURAL PURPOSES IN VARIOUS COUNTRIES, 1913 (2).

Country	Nitrate of soda		Sulphate of ammonia	
	Amount consumed	Nitrogen in amount consumed	Amount consumed	Nitrogen in amount consumed
	metric tons	metric tons	metric tons	metric tons
Germany.....	497 800	74 679	460 000	94 300
United Kingdom.....	133 000	19 950	97 000	19 885
France.....	355 000	53 250	90 000	18 450
Spain.....	13 800	2 070	57 000	11 685
Italy.....	44 600	6 690	29 500	6 047.5
Austria-Hungary.....	7 150	1 072.5	16 000	3 280
Belgium.....	308 200	46 230	42 000	8 610
Netherlands.....	183 000	27 450	8 000	1 610
Sweden.....	5 220	783	1 350	277
Denmark.....	4 900	735	700	134
Egypt.....	23 800	3 570	2 000	410
United States.....	485 000	72 750	235 000	48 175
Japan.....	21 700	3 255	115 000	23 575
Dutch Indies (Java).....	15 000	2 250	57 000	11 685

(1) Figures supplied by the Chilean Nitrate Propaganda.

(2) Figures supplied by the Deutsche Ammoniak-Vereinigung.

IX — SULPHUR EXPORTED FROM SICILY (1).

Country of destination	1913				1st half-year 1914				Total		
	Crude		Refined		Crude		Refined				
	in loaves	ground	in loaves	ground	in loaves	ground	in loaves	ground			
										Subli- mated	Tota	Subli- mated	Total
	m. tons	m. tons	m. tons	m. tons	m. tons	m. tons	m. tons	m. tons	m. tons	m. tons	m. tons
Italy	24 502	1 346	22 507	32 524	81 474	17 007	2 255	14 648	33 094	339	67 343
Austria	19 371	128	11 554	4 722	36 335	11 701	44	4 377	6 268	61	22 451
Belgium	9 047	65	3 170	200	13 320	3 195		201	617		4 103
Denmark			14	201	305				63		20
France	75 062		111	15	75 186	52 114		9	214		52 376
Germany	9 505	35	10 779	11 217	31 658	6 896		4 110	4 247	38	15 311
Greece	7 637	77	5 538	13 350	14 615		890	1 168	14 682		15 686
United Kingdom	1 425		5 637	1 200	18 030	1 939		1 623	4 096	10	7 233
Netherlands	3 003	10	1 002	6 702	8 975	42		1 732	395		2 018
Portugal	22 173	26	1 595	11 423	14 757	1 402	507	564	6 504	107	7 461
Russia	2 700		771	1 910	25 892	14 676		167	1 699	129	17 073
Rumania	1 350	601	1 040	3 257	3 710	1 495		742	413		2 075
Spain	19 378		54	110	6 684	993	376	83	6 804	42	8 867
Sweden					19 542	785			25		893
Turkey in Europe		3	299	1 597	1 911			114	1 037	4	1 175
Canada									388		388
United States	15		134	862	1 028			165	554		719
Argentine Republic	2 062	202	722	583	3 979			60	13		73
Brazil	951		893	527	2 425	20		44	148		212
Chile				520	712				96		96
Colombia					51						
Mexico			38	87	125			20			20
Peru			28	20	48			4			4
Venezuela											
Egypt			31	584	615			28	316		344
Algeria	2 370		13	68	2 370	525					526
Tunis	345	65	13	1 030	872	190	8	17	303	314	832
Union of South Africa	12 060		67	3 901	13 741	2 060		101	103		2 354
Turkey in Asia		3	42	3 501	3 506		2	45	3 492	293	3 832
British India		92	1 446	3 551	5 736	780		722	835		2 337
Australia	12 549		341	551	14 441	1 591		3			1 504
Other countries	50		2 137	4 137	6 049	1 582		2 167	1 152	6	4 007
Total	228 530	3 357	63 053	110 034	415 378	118 923	4 088	33 154	93 248	1 402	230 815
Mean value	£4 18s 4d	£4 10s 7d	£4 6s 11d	£4 17s 0d	£5 11s 6d	£4 18s 10d	£4 10s 7d	£4 6s 11d	£4 17s 0d	£4 5s 10d	£4 5s 10d

(1) Figures supplied by the "Consorzio solferino siciliano".

PRICES OF PHOSPHATES, POTASH SALTS AND NITROGENOUS
FERTILIZERS DURING THE FIRST HALF-YEAR, 1914.

Phosphates.

N. B. — *European prices are quoted per unit of 22.4 lbs.*

American prices are quoted per long ton.

I. — TUNISIAN PHOSPHATE, 58-63 PER CENT. (nominal quotations).

Markets	Mediterranean	United Kingdom	North Sea	Baltic
	<i>d</i>	<i>d</i>	<i>d</i>	<i>d</i>
End of January 1914.....	5	5	5 ¹ / ₈	5 ³ / ₈
» February 1914.....	4 ³ / ₄	4 ³ / ₄	4 ⁷ / ₈	5 ¹ / ₈
» March 1914.....	4 ³ / ₄	4 ³ / ₄	4 ⁷ / ₈	5 ¹ / ₈
» April 1914.....	4 ³ / ₄	4 ³ / ₄	4 ⁷ / ₈	5 ¹ / ₈
» May 1914.....	4 ³ / ₄	4 ³ / ₄	4 ⁷ / ₈	5 ¹ / ₈
» June 1914.....	4 ³ / ₄	4 ³ / ₄	4 ⁷ / ₈	5 ¹ / ₈

II. — ALGERIAN PHOSPHATE 63-70 PER CENT (nominal quotations).

Markets	Mediterranean	United Kingdom	North Sea	Baltic
	<i>d</i>	<i>d</i>	<i>d</i>	<i>d</i>
End of January 1914.....	5 ¹ / ₄	5 ¹ / ₄	5 ³ / ₈	5 ⁵ / ₈
» February 1914.....	5	5	5 ¹ / ₈	5 ³ / ₈
» March 1914.....	5	5	5 ¹ / ₈	5 ³ / ₈
» April 1914.....	5 ¹ / ₄	5 ³ / ₈	5 ³ / ₈	5 ¹ / ₂
» May 1914.....	5 ¹ / ₄	5 ³ / ₈	5 ³ / ₈	5 ¹ / ₂
» June 1914.....	5 ¹ / ₄	5 ³ / ₈	5 ³ / ₈	5 ¹ / ₂

III. — ALGERIAN PHOSPHATE, 58-63 PER CENT (nominal quotations).

Markets	Mediterranean	United Kingdom	North Sea	Baltic
	d	d	d	d
End of January 1914.....	5	5	5 ¹ / ₈	5 ³ / ₄
» » February »	4 ³ / ₄	4 ³ / ₄	4 ⁷ / ₈	5 ¹ / ₈
» » March »	4 ³ / ₄	4 ³ / ₄	4 ⁷ / ₈	5 ¹ / ₈
» » April »	4 ³ / ₄	4 ³ / ₄	4 ⁷ / ₈	5 ¹ / ₈
» » May »	4 ³ / ₄	4 ³ / ₄	4 ⁷ / ₈	5 ¹ / ₈
» » June »	4 ³ / ₄	4 ³ / ₄	4 ⁷ / ₈	5 ¹ / ₈

IV. — FLORIDA HARD ROCK, 77-80 PER CENT (European quotations nominal, American quotations f. o. b. Florida).

Markets	New York	Mediterranean	United Kingdom	North Sea	Baltic
	\$	d	d	d	d
End of January 1914	5.75-6.25	7 ¹ / ₄	6 ³ / ₄	6 ³ / ₄	7
» » February »	5.75-6.25	7	6 ¹ / ₂	6 ¹ / ₂	6 ³ / ₄
» » March »	5.75-6.25	7	6 ¹ / ₂	6 ¹ / ₂	6 ³ / ₄
» » April »	5.75-6.25	6 ³ / ₄	6 ³ / ₈	6 ¹ / ₂	6 ³ / ₄
» » May »	5.75-6.25	6 ³ / ₄	6 ¹ / ₄	6 ³ / ₈	6 ³ / ₄
» » June »	5.75-6.25	6 ³ / ₄	6 ¹ / ₄	6 ³ / ₈	6 ³ / ₄

V. — FLORIDA LAND PEBBLE, 68-73 PER CENT.
(European quotations nominal, American quotations f. o. b. Florida).

Markets	New York	Mediterranean	United Kingdom	North Sea	Baltic
	\$	d	d	d	d
End of January 1914	3.00-3.25	5 ⁵ / ₈	5 ¹ / ₈	5 ¹ / ₈	5 ³ / ₈
» » February »	3.00-3.25	5 ¹ / ₂	5	5	5 ¹ / ₄
» » March »	3.00-3.25	5 ¹ / ₂	5	5	5 ¹ / ₄
» » April »	3.00-3.25	5 ¹ / ₂	5	5	5 ¹ / ₄
» » May »	3.00-3.25	5 ¹ / ₂	5	5	5 ¹ / ₄
» » June »	3.00-3.25	5 ¹ / ₂	5	5	5 ¹ / ₄

VI. — SOUTH CAROLINA PHOSPHATE, 55-60 PER CENT.
(European quotations nominal, American quotations f. o. b. Mt. Pleasant).

Markets	New York	Medi- terranean	United Kingdom	North Sea	Baltic
	\$	d	d	d	d
End of January 1914...	3.50-3.75	5	4 ³ / ₄	4 ³ / ₄	4 ⁷ / ₈
» February » ...	3.50-3.75	5	4 ³ / ₄	4 ³ / ₄	4 ⁷ / ₈
» March » ...	3.50-3.75	5	4 ³ / ₄	4 ³ / ₄	4 ⁷ / ₈
» April » ...	3.50-3.75	5	4 ³ / ₄	4 ³ / ₄	4 ⁷ / ₈
» May » ...	3.50-3.75	5	4 ³ / ₄	4 ³ / ₄	4 ⁷ / ₈
» June » ...	3.50-3.75	5	4 ³ / ₄	4 ³ / ₄	4 ⁷ / ₈

VII. — TENNESSEE PHOSPHATE, 78-80 PER CENT.
(European quotations nominal, American quotations f. o. b. Mt. Pleasant).

Market	New York	Medi- terranean	United Kingdom	North Sea	Baltic
	\$	d	d	d	d
End of January 1914 ..	5.00-5.50	7	6 ¹ / ₂	6 ¹ / ₂	6 ³ / ₄
» February » ..	5.00-5.50	6 ³ / ₄	6 ¹ / ₄	6 ¹ / ₄	6 ¹ / ₂
» March » ..	5.00-5.50	6 ³ / ₄	6 ¹ / ₄	6 ¹ / ₄	6 ¹ / ₂
» April » ..	5.00-5.50	6 ³ / ₄	6 ¹ / ₄	6 ¹ / ₄	6 ¹ / ₂
» May » ..	5.00-5.50	6 ³ / ₄	6 ¹ / ₄	6 ¹ / ₄	6 ¹ / ₂
» June » ..	5.00-5.50	6 ³ / ₄	6 ¹ / ₄	6 ¹ / ₄	6 ¹ / ₂

VIII. — CHRISTMAS ISLAND PHOSPHATE (nominal quotations).

Market	Medi- terranean	United Kingdom	North Sea	Baltic
	d	d	d	d
End of January 1914.....	8 ¹ / ₄	8	8 ¹ / ₄	8 ¹ / ₄
» February »	8	7 ³ / ₄	8	8
» March »	8	7 ³ / ₄	8	8
» April »	8 ¹ / ₄	8	8	8
» May »	8 ¹ / ₄	8	8	8
» June »	8 ¹ / ₄	8	8	8

IX. — OCEAN ISLAND PHOSPHATE (nominal quotations).

Markets	Mediterranean	United Kingdom	North Sea	Baltic
	d	d	d	d
End of January 1914	8 ¹ / ₄	8	8 ¹ / ₄	8 ¹ / ₄
» » February »	8	7 ³ / ₄	8	8
» » March »	8	7 ³ / ₄	8	8
» » April »	8 ¹ / ₄	8	8	8
» » May »	8 ¹ / ₄	8	8	8
» » June »	8 ¹ / ₄	8	8	8

Potash Salts.

X. — MAXIMUM PRICES FOR POTASH SALTS FIXED BY GERMAN LAW.

	Potash content	Per unit of 22.4 lbs
	per cent.	s d
Carnallite	9-12 (ground)	10 ¹ / ₄
Crude salts (kainite, hartsalz, sylvinite)	12-15 (ground)	0
Potash manure salts	20-22	1 4 ⁵ / ₄
» » »	30-32	1 5 ¹ / ₂
» » »	40-42	1 6 ¹ / ₂
Chloride of potash	50-60	2 8 ¹ / ₄
» » »	above 60	2 10 ⁵ / ₈
Sulphate » »	above 42	3 5 ⁷ / ₈
» » » magnesia .....	.....	3 1

XI. — CURRENT PRICE OF POTASH SALTS IN GERMANY, CALCULATED
FROM TABLE X.

Nature of salts	Potash content	Price per ton		
	per cent.	£	s	d
Carnallite.....	9	7	7	
»	10	8	6	
»	11	9	4	
Kainite (hartsalz or sylvinites).....	12	12	0	
» » »	13	13	0	
» » »	14	14	0	
» » »	15	15	0	
Potash manure salts.....	20	1	8	0
» » »	21	1	9	6
» » »	22	1	10	10
» » »	30	2	3	3
» » »	31	2	4	8
» » »	32	2	6	2
» » »	40	3	1	8
» » »	41	3	3	2
» » »	42	3	5	0
Kainite, ground fine, special type for the destruction of weeds.....			5	0
			(extra)	

The above prices (Tables X and XI) refer to fertilizers consumed in Germany. For other countries the prices are fixed each year at the beginning of the season and are reckoned as at Stassfurt, always at higher prices than the same fertilizers intended for home use.

XII. — PRICES OF POTASH SALTS AT NEW YORK, JANUARY-JUNE, 1914.

Nature of salts	Potash content	Price per long ton		
	per cent.	\$	£	s d
Kainite	12.4	8.36	1	14 4
Hartsalz	16	10.87	2	4 8
Potash manure salt.....	20	13.58	2	15 9
Double » »	48-53	25.04	5	2 10
Sulphate of potash.....	90-95	47.57	9	15 4
Chloride » »	80-85	41.65	8	11 6
» » »	95	40.75	8	7 4
» » »	98	39.07	8	0 6

The New York market prices are used by the experiment stations to value commercial fertilizers in the States in which the fertilizer trade is controlled.

Nitrogenous Fertilizers.

XIII. — PRICES OF NITRATE OF SODA PER LONG TON ON THE SPOT.

Markets *	Antwerp	Dunkirk	Genoa	Hamburg	Liverpool	New York	Rotterdam
	£ s d	£ s d	£ s d	£ s d	£ s d	£ s d	£ s d
January 1914.....	9 18 7	9 19 5	10 11 6	9 19 5	10 8 6	10 4 10	10 1 11
February "	10 6 3	10 9 6	10 11 6	10 9 5	10 10 0	10 4 10	10 10 10
March "	10 0 3	10 2 3	10 11 6	10 4 11	10 11 10	10 4 19	10 5 11
April "	9 8 6	9 10 2	10 4 5	9 9 0	10 6 3	10 4 10	9 12 0
May "	9 11 4	9 12 7	10 2 2	9 14 0	9 18 6	10 4 4	9 13 0
June "	9 13 4	9 18 7	10 2 2	9 10 0	9 17 6	9 17 11	9 15 0

* All quotations are for the end of the month except in the case of Liverpool which, gives average prices for the month.

XIV. — PRICES OF SULPHATE OF AMMONIA PER LONG TON ON THE SPOT.

Markets	Antwerp Comptoir end of the month	Genoa (end of the month)		Hull (middle of the month)	New York (end of the month)	Paris (end of the month)
	£ s d	£ s d	£ s d	£ s d	£ s d	£ s d
January 1914 ...	12 19 10	13 7 11	13 10 0	12 7 6	13 2 4	12 17 10
February " ...	13 1 10	13 5 11	13 7 12	12 9 8	13 2 4	12 13 9
March " ...	13 1 10	13 3 10	13 7 11	12 7 6	13 2 4	12 13 9
April " ...	11 17 8	12 17 10	13 1 10	12 4 2	13 2 4	12 5 9
May " ...	10 17 6	12 9 9	12 11 10	11 6 0	12 8 7	11 13 8
June " ...	11 1 7	12 7 9	12 9 9	10 9 4	11 7 10	11 11 8

XV. — WHOLESALE PRICE OF NITROGEN PER UNIT OF 22.4 LBS AT ANTWERP.

Nitrogen contained in :	Nitrate of soda	Sulphate of ammonia	Calcium cyanamide	Nitrate of lime
	s d	s d	s d	s d
End of January 1914.....	12 10	12 10	12 2	14 8
" February "	13 3	13 0	12 2	14 8
" March "	13 0	13 0	12 2
" April "	12 1	11 9	12 2
" May "	12 4	10 9
" June "	12 5	10 11

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FIRST PART.
ORIGINAL ARTICLES

Agricultural Education in Hungary

by

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Agricultural instruction in Hungary is given in the following special educational establishments :

Royal Veterinary College at Budapest.

Royal Agricultural College.

Agricultural Training Colleges for primary school teachers.

Schools of Practical Agriculture.

Royal Dairy School.

School for Dairymen.

Other schools for special branches.

There are further 28 lecturers from the Training Colleges acting as district organisers and advisors.

Royal Veterinary College at Budapest. — This institute : *a)* provides a course of instruction and training in veterinary science ; *b)* grants licenses to veterinary surgeons ; *c)* furthers the interests of veterinary science by observations and experiments ; *d)* provides expert opinion for questions of veterinary science and hygiene ; and *e)* obtains information for Government purposes or for the Law Courts on veterinary questions. The course lasts four years (eight terms) and students to be admitted require to have taken the school leaving examination of the middle schools ; terms kept in a foreign veterinary school of similar standard are recognised and the course leads to graduation with a doctor's degree. The staff consists of a director, twenty lecturers and 25 assistants and clerks. During the session 1912-1913, 190 students were in attendance.

Royal Agricultural Colleges. — Students having been through the middle schools and requiring a higher agricultural education, both practical and theoretical, go to one of the five Royal Colleges at Debreczen, Kassa, Keszthely, Kolossvár and Magyaróvár respectively. These institu-

tions take both full-time students and those who only wish to follow certain lectures. The course lasts three years (6 terms) and during the first year the instruction chiefly takes the form of practical work. The following subjects are taught at the Colleges: natural history, physics, plant production, rural economics, social economics, and practical agriculture including special branches.

Each College has a farm of 640 to 1100 acres attached to it for instruction in the actual practical work. Besides teaching, the staff carries on a certain amount of experimental work and advises on agricultural questions, for which purpose an agricultural consulting committee has been organised in each institution. During the session 1912-1913, 452 full-time and 9 part-time students were in attendance. The capital involved in these institutions amounts to £267 808, while the returns from the farms in 1913 were £3 144 (1).

Training Colleges for Elementary School Teachers. — Two training colleges have been established, one at Kecskemét for men and the other at Komárom for women (2) in connection with the Schools of Practical Agriculture in those places. Students who have taken the college diploma may become teachers in the rural complementary schools and some of the women students take up posts in the schools of domestic economy. The course lasts two years and only those candidates are admitted who already have their teacher's certificate and are under certain age limits, *viz.* twenty-two and twenty-four years old for men and women respectively. Forty students can be taken at Kecskemét and thirty at Komárom; the teaching staff amounts to seven and five lecturers respectively. Instruction is both practical and theoretical, the performance of a certain amount of practical work being compulsory. Women students are given general instruction in domestic economy as well as in agricultural subjects. Excursions are arranged to visit model farms in districts where poultry farming and market gardening are important industries, in order to provide the students with good object lessons in those branches. The students are further called upon to give popular lectures and demonstrations as part of their training.

Schools of Practical Agriculture. — These are the most elementary agricultural schools in Hungary and provide technical instruction to the sons of small farmers and under-managers on large estates. They are under Government administration and their organisation varies with the requirements of the district in which they are situated: for instance those at Ada, Békéscsaba, Hodmezővásárhely, Jászberény, Karczag, Kecskemét, and Nagykálló have a six-months course for farmers and small landowners in the general management of holdings, while the schools at Kisszeben, Lugos, Pápa, Rimaszombat, Somogyzentimre, Algyógy, Breznóbánya, Csák, Csikszerebia, Komárom, Nagyszentmiklós and Szilágyosmlyó have

(1) See also No. 453, B. May 1913.

(2) See No. 402, B. May 1914.

a two-year course and give more advanced instruction adapted to the training of farmers, under-managers and inspectors.

In all these schools the instruction is chiefly of a practical nature and much stress is laid on the satisfactory performance of the various kinds of manual work; on the theoretical side, only the most fundamental and indispensable facts are treated, the object being to keep the whole scheme of education at a popular level. Schools which are destined solely for the training of under-managers take pupils of twenty-two years of age, preferably after they have finished their military training; other schools admit pupils of seventeen years old and upwards. At Algyógy there is accommodation for sixty internal students, who do all the practical work in both the fields and the garden.

Short elementary courses, lasting two months, are organised at these schools during the winter for adults who cannot leave their farms for a longer period of time. Besides these, short summer courses lasting four weeks are held for elementary school teachers who wish to qualify as complementary school teachers, and popular lectures are given to the farmers of the district on the use of farm implements and the cultivation of special crops. During the winter the regular students receive instruction in the domestic industries. All teaching is done in the simplest language and illustrated with practical experiment and demonstration; for this reason, special importance is laid on the organisation and equipment of the model farms, which cover altogether an area of 11 700 acres, part of which is State owned while the rest is either let or given rent-free by landowners. The returns on these farms for 1913 amounted to £4873.

The staff of each school consists of a director, an agricultural demonstrator, a gardener and a practical assistant.

Besides these State schools there is an Agricultural School belonging to the town of Szabadka staffed by Government teachers. Private Agricultural Schools receiving State grants are also to be found at Csákvár, Bezstercze, Földvár and Medgyes; they are organised on similar lines to the State schools.

Royal Dairy School at Sárvár. — This institution provides suitable training for managers or skilled workmen of milk and cheese factories. Though all students receive both practical and theoretical instruction they are divided into two classes according as they are preparing to become managers or skilled workmen. The former class have to be over twenty years of age and to have already been through a course at a school of practical agriculture; the latter class are admitted at seventeen and only require to be able to read and write; during the session 1912-1913 attendances numbered 4 students of the former class and 17 of the latter. The course lasts one year.

Schools for Dairymen. — There are two of these, at Kisbér and Csák. The course is essentially practical and lasts one year.

The State Lecturers who teach agriculture in the agricultural colleges also act as advisors and organisers in the various districts, write agricultural articles for the local papers, give lectures and

supervise model farms. Besides these twenty-eight lecturers there are two lecturers in secondary boys' schools to help with the general organising and advisory work and four specialists to advise more particularly on the cultivation of potatoes, hops, hemp and flax, and on the improvement of pastures.

A *School of Domestic Economy* has been created at Putnok for the daughters of farmers, while seven travelling schools each under the control of two teachers give courses lasting six weeks in other parts of the country. They receive State grants amounting to £1665 annually.

During the winter popular agricultural lectures are given, towards which the State makes an annual grant of £4170.

Special schools also exist for the various branches of agriculture, such as poultry keeping, bee keeping, viticulture, horticulture, forestry, etc.

In conclusion the following figures summarise the annual expenditure by the Hungarian Government on agricultural education, which is almost entirely directly dependent on the State.

	Ordinary expenditure £	Extraordinary expenditure £
Royal Veterinary College	21 846	4 417
Agricultural Colleges.	48 929	9 792
Lower agricultural education, including advisory and organising work	84 047	22 000
Totals . . .	154 822	36 209

Reclamation in the Province of Ferrara

by

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The agricultural awakening of the Province of Ferrara has been closely connected with the carrying out of the projects of reclamation; this work was begun under the rule of the Este family, but reached its greatest development in the second half of last century, when, with the help of modern engineering methods, human activity was able to attack and conquer the problems entailed in the definite and permanent reclamation of the marshes and lagoons.

The traces of the work carried out by the organizations formed to deal with these problems as far as the then existing means would allow will never be effaced: the division of the Ferrara territory into four drainage districts still exists, and it may truly be said that the colossal work of mechanical drainage performed on the second and third of these forms one of the most imposing monuments to the civilization of the third Italy.

Out of the 655 000 acres forming the territory of the Province, one may reckon 155 000 as still occupied by bracks used for fishing (115 000 acres) or by rivers, canals, buildings, etc.; the remaining half a million acres represent the raw material of agricultural and forest production. The last-named may be left out of consideration, as the woods occupy hardly as much as 6 500 acres, mostly in the territory of Mesola, — a poor remnant, which, with the classical pinetum of Ravenna, serves to recall the vast forests of holm-oak and pine which in ancient times clothed the further margins of the lagoons of Venice and the Romagna.

The survey of 1835 divided this area of 500 000 acres into 204 020 acres of field crops, 172 080 acres of natural meadows and pastures, and 105 953 acres of reed-beds; the data for the agricultural survey of 1906 show 399 608 acres of crops and 80 015 acres of meadow, leaving some 15 000 acres for woods and vineyards.

These figures give a clear idea of the scope of the reclamation work: the arable area has been *doubled* as a result of draining the marshes and the "meadows and pastures" — a euphemistic way of referring to swamps, nearly or quite unproductive; these have been turned into highly fertile plains on which wheat, hemp, beets and leys extend yearly and give such enormous crops that this land must be considered as among the most productive in the whole of Italy.

At the present time the agricultural land of Ferrara consists of a complex patchwork of newly-reclaimed plots with the ancient holdings and "old lands" under cultivation for centuries. Although the contemporary period of this story contains many unfortunate episodes, so that with the names of the successful men must be mentioned others who have spent their labour and means in vain, yet the impetus to further conquests shows no diminution. There are already 215 000 acres from which the drainage-water is drawn off by 18 pumping-stations, and projects are on foot for two further areas, each of some 20 000 acres: one belonging to the northern levels ("valli") of Comacchio, and the other in the salt levels of Argenta and Porto Maggiore, which will form the so-called Mantello innings ("bonifica del Mantello").

In contrast with this land drained mechanically by pumps — that is the typical Ferrarese type of undertaking — should be considered the land in the commune of Bondeno which has a natural outlet, the water flowing off by means of the great canal of Burana or Volano, which passes under the river Panaro by means of the famous "Botte Napoleonica". This vast zone of reclaimed land consists of 26 690 acres in the Province of Ferrara, 54 750 acres in the Province of Modena and 47 060 acres in the Province of Mantua. With the drainage water from this great basin and the possibility of receiving water from the main stream of the Po through the Pilastresi sluices, the old Volano course of the Po has again become a river rather than a canal, and indeed for a considerable distance has a natural fall; it has also become the principal waterway of the Ferrara district, as well as a source of water for agricultural purposes.

The particulars of these reclaimed lands have been given in detail in various publications, to which we would refer readers who wish to study the question more in detail. In this short account it seems best to confine our attention to certain features of a general character.

From the purely technical point of view reference should first be made to the great difference in the problems presented according as the land has been reclaimed from freshwater or from saline marshes ("valli dolci" or "valli salse").

The low-lying parts of the *freshwater marshes*, prior to drainage, were occupied by a more or less vigorous growth of reeds or other marsh plants. The succession of generations of such rhizomatous plants for centuries has given rise to strata of peat ("cuora"), in some places reaching a sufficient depth to allow of utilization for burning or as raw material for certain industries. But even these marshes rest on a distinctly saline subsoil, as can be seen at once from the nature of the water at some depth. Except for the markedly peaty areas, which require quite special treatment, one may say that these soils present no special obstacles to opening up for cultivation. With systematic treatment they may in a short time be put under highly paying crops. The fact that sufficient care has not always been taken in dividing up these lands is due to difficulties of a different character (to which we shall refer shortly) and not to the physical characters of the soil.

The behaviour of the land obtained by reclaiming *salt areas*, or *bracks*, is totally different, and as the new schemes refer to the innings of land covered by salt water it seems advisable to go more into detail on this point. Anyone familiar with the "Gallare" — typical of innings of this kind — or similar farms, such as what was once the Tassoni brack (reclaimed by Cav. M. Marini), knows that considerable areas may remain refractory to the usual methods of cultivation for several decades after the completion of the engineering works freeing them from water. Soils impregnated with saline matter, such as those inned from the lagoon, require special treatment to deal with the sterility resulting from the accumulation and continual change of level of these salts in the arable layer. We may here mention one or two fundamental points of such treatment not always remembered by the promoters of the reclamation of the bracks: owing to the position of these soils, their physical and chemical composition and their structure, and owing to the enormous quantity of salt contained in the mass, the possibility of profitable cultivation — when the engineering work is finished — is not only dependent on a period of absolute unproductivity, much longer than is generally admitted, but even later is subject to variations which cannot be foreseen and which are due to the special behaviour of the saline matter.

We have already given prominence to these considerations, though fully aware that they cannot outbalance the reasons of a social nature and especially of convenience which have created an opinion decidedly favourable to the carrying out of the reclamation of the stretches of lagoon in question. It would be well that the example of the practical results

furnished by the reclamations already accomplished should not be taken as the only criterion for the opening up and improvement of the neighbouring land, which is not always in a suitable condition for reclamation with a view to agricultural use. The planning, the execution and the completion of the past, present and future reclamations should not be effected entirely to the detriment of the "water farming" (*vallicoltura*); an investigation should be undertaken with a view to establishing once for all the productive capacity of this land under water and the best means of encouraging a reasonable and intensive "farming" of it; such "farming" requires far less sinking of capital and at the same time lends itself to the natural tendencies of the local inhabitants concerned, so that it might well hold its own in comparison with the arable land to be inned from these inlets of the lagoon.

The fundamental work of reclamation for both freshwater and salt lands consists in drying, that is in the mechanical drawing-off of the ground water. There is not the slightest doubt as to the perfection with which this is now carried out by the engineers, who are thoroughly versed in the setting up of the necessary plant and in the maintenance of the scheme of drainage; in all the operations so far carried out the removal of the water was obtained in the most perfect and simple manner possible; though the methodical evacuation of the water is the primary necessity for these tracts lying at such a very low level, it is only one side of the complex problem entailed in opening them up for agricultural use.

This drying is naturally only relative, allowing a certain depth of free soil above the water-table. For this reason the individual characteristics of the different soils, especially, as regards water-holding capacity, should be taken into account; evidently sandy and clay lands cannot have the same treatment. The possibility of cultivating these reclaimed lands properly depends in particular on the reserves of water which the crops find at their disposal, and obviously an excessive drying may be as injurious as a condition of stagnation leading to swamp formation.

The working of the pumping engines is so regulated as to avoid any danger in this direction. In some of the very large sections covering something like 100 000 acres there are considerable differences in level; in such cases it is now the rule to keep the so-called high-level water separate from the low-level water, the two being dealt with by different pumping stations. As an example of this may be mentioned the system adopted by the Association for the "Grande Bonifica"; for the completion of this area, carried out between 1905 and 1910, they rearranged the old station at Codigoro to dispose of the high-level water (from an area of 39 929 acres), while the low-level water (from 89 875 acres) runs off by means of a new station put up close to the old one.

Although the drying is carried out in accordance with the needs of the crops, these are subject to the same risks as those on the neighbouring old lands as regards water supply. Indeed seasons in which the yield of these artificially dried soils is seriously reduced by drought are by no means rare.

In fact drought makes itself felt more severely on these soils, as the water is liable to take up mineral matter from the subsoil, constantly impregnated with salt, and may thus become too saline for the ordinary crops. We have elsewhere had occasion to refer to the difficulties attendant upon the excess of saline matter in the water taken up by the arable layer, which may provoke a special condition of "physiological drought"; the same point has been referred to by Tacke in his masterly advice on the water economy of moor and fen soils: "The drawing-off of the water must be done with great care, as organic soils retain large quantities of water with such tenacity that the roots of the plants growing in them cannot make use of it; in such soils plants may suffer from lack of water in presence of considerable quantities of it....; once the stagnant water has been dealt with and the land brought under cultivation, only small amounts of water should be drained off".

Pure sandy soils require similar treatment, as their productivity depends entirely on the presence of the water-table near enough to the surface to be within reach of the roots. The vineyards of Comacchio and parts of the cultivated land of the Mesola are in a flourishing condition solely because the water conditions have not been disturbed; they form a marked contrast to certain old sandhills wedged in between low-lying reclaimed zones and consequently subject to excessive drainage: the careful running-off of the rainwater and the lowering of the water-level in the soil have led inevitably to absolute sterility in the higher sandhill tracts. In the modern work of completion of the Grande Bonifica it was recognized that this area would have to be isolated from the remainder and submitted to special treatment suitable for sandy land.

So far no plans have been made for correcting any possible deficiencies in the drainage schemes by means of irrigation. It is certainly very exasperating in some years to have to watch the crops daily drying up owing to continued drought, while up above the Grande Bonifica rises the great bank holding in the water of the Po on its way to the sea; the Po water is, however, coming to be used for hygienic and agricultural purposes, as the need has become more acute with the yearly increase of the permanent population of the reclaimed lands.

It should be recognized that while the removal of the water — the main scope of the *engineering reclamation* — presents great difficulties, the difficulties encountered in the *agricultural reclamation* — that is opening up the land for cultivation and colonization — are equally serious, if not more so. The water from the ditches and main drains, as well as the ordinary well water, is absolutely unfit for watering cattle or for household and agricultural purposes; it is charged with saline and organic matter and becomes putrid in summer. Petitions for a supply of drinking water used frequently to be made by the people of the reclaimed areas and it was owing to the initiative of the Commune of Iolanda di Savoia that the legislation in vigour was altered, so that by the law of June 25 and July 13, 1911, communes in reclamation areas were added to the list of those allowed special facilities for the provision of drinking water. "If our

Commune, planned and founded contemporaneously with the carrying out of the reclamation scheme, cannot boast a past, it may well be proud of its present work": so said Comm. A. Marangoni, who has been intimately connected with the Grande Bonifica of Ferrara, on the 15th of June, 1913, in opening the communal aqueduct, by means of which Iolanda di Savoia "has no longer fetid and stagnant water spreading fever and death, but pure and healthy water shooting up to many feet above the ground and bringing healthy and vigorous life to these redeemed lands."

In the vast area of the Grande Bonifica (133 000 acres) provision has been made for obtaining water from the Po by means of four syphons, planned and constructed under the direction of Ing. Pasini. All the farms in the area feel the benefits of this work in completion of the reclamation, as they can provide water for the watering of live stock, for household use and for retting hemp. A logical finishing touch would have been the carrying out of Ing. O. Balduzzi's scheme for a Po valley aqueduct, to provide drinking water to the 103 200 inhabitants of 11 communes lacking it. As this remained in the condition of a project, the Ferrarese Reclamation Society — whose land makes up the greater part of the Commune of Iolanda di Savoia — with its usual enterprise, took up the construction of the communal aqueduct under the provisions of the law mentioned; the Po water is filtered and purified on the Puech-Chatal system and brought into the area by a steel conduit 18 miles long; finally it is distributed to the chief farms and groups of houses in the territory of the commune at the rate of 14 000 cu. ft. per day.

The Volano Po, or Burana, which runs from west to east through the province of Ferrara, has also been laid under contribution for water for agricultural purposes. Its value has been increased since the construction of the Pilastresi sluices has allowed water from the main Po to be run into it, but unfortunately the Burana is, and will continue to be, chiefly a drainage canal into which are run the waters from the 3rd, 4th, and 6th sections of the Burana innings: it also receives the water from the hemp-retting and in particular the refuse water from the sugar factories along its course. For these reasons water from it has a very limited use, and one of the associations most concerned is now making plans for obtaining water direct from the Po for the needs of its vast territory.

While the provision of water for agricultural purposes in this 3rd drainage section is difficult and costly, the provision of drinking water is equally so and sometimes not economically possible: we do not here refer to ordinary wells, as with rare exceptions the water they give is scanty and bad. So far the best results have been obtained by deep tubular wells, of which there are a certain number here and there in the Ferrarrese territory. Their depth varies from 80 to 600 ft.; some only lasted for a very short time, while the use of the water from some others was prohibited for preposterous hygienic reasons about the quality. Special mention should be made of the well bored at the Bastioni farm on the Val Gallare property; this is nearly 600 ft. deep and for over thirty years has given a constant supply of about 1 $\frac{1}{2}$ gallon per second. Last year this source was covered

in, and after filtration it is now distributed through 12 miles of steel tubing to 40 fountains at the numerous farms round.

Yet another vital problem of the reclaimed zones remains to be mentioned, namely the question of means of communication: there are still large areas inaccessible for several months in the year owing to lack of roads; the laying of good roads to connect the reclaimed lands with the nearest centres requires a great outlay. Happily the most economic means of transport of agricultural produce, namely by water, can to some extent be substituted for roads, which in these one-time bracks are yet to come. The chief canals have indeed been arranged so as to be navigable, but access to the wharves or landing-stages must be provided and the farms must be joined up one to another and to the nearest centres. There is no need to go deeply into the question, as the above will suffice to call attention to one of the causes which has contributed and still contributes to retard colonization of the reclaimed areas.

These considerations indicate that it would be very instructive to make an investigation into the real cost of reclaimed land, especially so as to be able to make proper comparisons as to the utility of continuing the inking at the expense of the lagoon. There is a fundamental difference between schemes which have in view the reclamation of land at present more or less completely and constantly submerged under salt water, and such schemes as the great Rhine reclamation, now being carried out, in which it is a question of laying out permanent drainage for vast stretches of land whose productive power is paralyzed by the lack of a proper outlet for their waters. Probably, however, the calculation of the true total cost of such reclamation can never be made: it would show up the perseverance and strong spirit of initiative possessed by the past generation of farmers, who selected this extreme corner of the Po Valley for their operations. The names of Count Francesco Aventi, Count Luigi Gulinelli and Ing. Gerolamo Chizzolini — to mention only some of those no longer living — will always be remembered as among the numerous band of pioneers who devoted brains and money to carrying through this reclamation work. It should be repeated here that the fundamental work of engineering reclamation was performed on private initiative and with private capital, at a time when the Government seemed almost ignorant of the existence of any such important problems. It was only after the passing of the law of 1882, modified in 1901, that the State took a part in the completion of the work.

It will still be possible to calculate what has been spent by the State and by local bodies in completion of the work, at any rate where such expenditure was undertaken to satisfy collective needs. But the total sum sunk by private persons defies all attempts at estimation, whether it be that expended on the large properties organized on industrial lines or that due to large, medium or small landowners.

Among the large organizations for intensive cultivation or industrialized agriculture, special mention should be made of the Ferrara Land Reclamation Society and its derivatives — the Immobiliare Lodigiana, the Immo-

biliare Veneta and the Amministrazione Mazzotti, besides other smaller ones comprised in the Association for the Grande Bonifica — and of the Val Gallare and Valle Volta Societies, comprised in the 2nd section; all these have been the subject of numerous publications and serve as object lessons for all engineers and agriculturists. No less worthy of mention are the numerous farms whose present prosperity is the fruit of the labours and faith in the agricultural industry of the much abused class of large and small Ferrarese landowners.

The fertility of the redeemed land, after it has been properly laid out, has often been referred to: yields per acre exceeding 37 bushels for wheat, 16 tons of beets and 12 cwt. of hemp lint are by no means exceptional. There are still a few pieces of land, which as Prof. Munerati wrote some time ago, have not yet been awakened by phosphatic manuring, the foundation-stone of scientific agriculture; such lands require an enormous expenditure of capital to bring them under cultivation, and they have absorbed and continue to absorb a large part of the returns given by the crops on them.

In the early years of cultivation these lands were robbed by excessive grain-growing: they form another example of the specialized agriculture which is started wherever virgin land is suddenly opened up for farming, as shown by the agricultural history of all countries. But this extensive cultivation had a short life; these reclaimed lands gradually came to resemble the densely populated old lands surrounding them, as regards the working plan, the arrangement of the farms and the means of production.

The tendency is to form farms of about 75 acres — the old-fashioned "versuro" — which, at any rate in the early stages, are run on the "boarico" (1) contract system. Many private estates have already reached this condition, and modern necessities incline to still further reduction of the holdings, so as to make them suitable for farming on the métayer system or for letting to colonizing families. On the larger estates such division exists only in theory, as the complex circumstances already mentioned prevent its being carried into practice.

We may finish up with a few statistics, which refer to the whole province of Ferrara and not only to the reclaimed areas. The following table

Crop	Average 1862-1871		Average 1909-1913	
	Per acre	Total	Per acre	Total
Wheat bushels	16.26	1 875 335	29.13	4 323 935
Hemp cwt. .	6.3	294 375	9.0	619 900
Beets tons . .	—	—	14.9	226 966

(1) The "boarico" contract is one in which a head ploughman is put in charge of a certain number of teams of oxen; he is housed and receives part money wages and part wages in kind. (Ed.)

gives the average yields of certain crops for the decade 1862-71 in comparison with the agricultural statistics for the 5-year period 1909-13.

The cattle numbered 70 000 in the 1869 census and 110 320 in the 1908 census.

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The Swine Raising Industry in Canada

by

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The swine raising industry in Canada is closely allied with what may be termed general agriculture or mixed farming. Even the early settlers raised a few hogs to supply themselves with meat and to provide a product acceptable to the local merchant in exchange for products of commerce. With the development of urban populations and the growth of the lumbering industry, there grew up a demand for pork products. In the case of beef, the butcher very early became a necessary factor, while in the swine industry, the farm continued to combine the breeding and feeding operations with the slaughtering and curing of meat. Then there arose a more or less extensive fresh pork trade, but it was not until the packing houses were established about 1860 that an export trade began.

Of the early years of the industry, Mr. William Davies of Toronto, the pioneer pork packer of Canada, writes :

Fifty years ago or even more, large numbers of dressed hogs were brought by farmers to Toronto. Besides the few that were bought by local dealers many were bought by commission men in the city for local operators in Montreal. These carcasses were chopped up and packed in barrels with a certain amount of salt, then coopered up tight and filled with water and brine. These barrels were then shipped by boat to the consignees in Montreal. In a few instances they were taken down by local Toronto men. Arrived in Montreal these barrels of pork were taken to a Government Inspection Warehouse. The inspectors were sworn Government Officials and they made out a bill for each owner specifying so many barrels of mess pork, so many of prime mess, etc., and armed with this certified bill the products could be sold to Montreal merchants, from whom the stuff found its way into the pinneries to feed the lumbermen. At that day there was positively no export trade. Soon

after that a reciprocity treaty with the United States was enacted and as hogs were much more plentiful in the United States than in Canada, and mess pork in barrels was put up in the United States on a very large scale, it came to Canada duty free and thus there was a considerable surplus available for export, especially as the kind of hogs desirable for the lumbermen's use were "mammoths" while the sort desirable for export were "light weights". From that time the export business increased largely.

While the market for Canadian pork products was confined principally to a home demand, there was no incentive to change from the customs that had become well established, but so soon as there was an appreciable quantity for export, the requirements of the importing country had to be reckoned with.

It was, as it is today, the business of the farmer to raise the hogs, but to find a market depended upon the commercial man, who, in this case, was the pork packer. Fortunately for the industry, which expanded very rapidly, there were in Canada farseeing men engaged in the packing business, and on these the swine raising industry depended more than upon any other agency. They set about developing the right kind of hogs for the best trade.

The English market demanded medium weight hams and "Wiltshire sides" full of lean meat. Experience taught the packers that the Yorkshire and Tamworth breeds excelled in these particulars. To encourage farmers to raise hogs of these breeds, leading packers imported boars and distributed them in hog raising sections. This was done in sections of Ontario about 1890. The result was very pronounced and in the desired direction, for in a few years Canadian hog meats became very popular on the British market.

The possibilities of the bacon industry appealed to Provincial and Dominion Governments perhaps more especially at the beginning. The Ontario Department of Agriculture during several years in the nineties conducted a most effective campaign on behalf of the "bacon" hog. By means of Winter Fairs and Farmer's Institute meetings, Ontario farmers were shown conclusively that the "bacon" hog was the most profitable to raise and the most readily sold in the best markets of the world. The correctness of the teaching in those days is amply borne out by the report of the Swine Commissioner who visited Denmark and found that the Danish pig, from which the highest-priced bacon in England is made, corresponds exactly with the pigs advocated for Canadian farmers and at the present time raised by them in every province. The results of this campaign of education were so pronounced that within a few years the railroads leading to the large packing houses were loading hogs at almost every country station once or oftener weekly with stock that came well up to the standard for the export trade.

Nor were the other provinces asleep in regard to the swine breeding industry, as in each one of them excellent progress has been made, more especially in the matter of quality. In each and every province the "bacon" hog is the Standard and the pigs that win the best awards in the Eastern provinces are of the same general type, age and weight as those that take the best awards in Ontario and in the Western provinces.

The Federal Department of Agriculture has done much to uplift the industry, more especially in the provinces outside of Ontario. Through the Branch of the Live Stock Commissioner the teaching commenced in Ontario has been extended to other parts of the Dominion both at Institute meetings and Winter Fairs, while these latter organizations have been induced to frame their prize lists so as to encourage only breeds of the "bacon" type. The Federal Department of Agriculture, in conjunction with other agencies, has also distributed by means of section sales and through Farmer's Clubs breeding swine of superior quality. Then the Experimental Farms have rendered and continue to render a highly valuable service in experiments carried on more especially at the Central Farm, where the questions of economical feeding and sanitary housing have been very largely solved.

The Export Trade.

From small beginnings in the early nineties, the export bacon trade with Great Britain grew by rapid strides until in 1905 Canada supplied the Mother Country with about 20 per cent of her imported bacon. For a number of years a highly satisfactory export trade was maintained, but since 1907, a decline has been in operation until Canadian supplies to the Old Land have fallen to about one-third what they were when the trade was at its height.

It must be noted that up to about 1884 much of the export pork was made from United States hogs. Soon after that time Canadian hogs were raised in sufficient number to keep the packing houses supplied.

The following table shows the exports of bacon, hams and pork from 1868 to the fall of 1913.

Exports of Bacon from Canada.

Fiscal Year	Bacon	Hams	Pork	Total
	lbs.	lbs.	lbs.	lbs.
1868	—	10 580 528	3 506 048	14 086 576
1870	—	19 627 216	6 544 384	26 171 600
1880	8 616 739	955 603	1 281 391	10 853 733
1885	7 189 260	962 827	555 436	8 707 523
1890	7 235 336	256 746	233 899	7 725 981
1895	37 526 058	2 607 968	519 736	40 653 762
1900	132 175 688	2 856 186	1 109 550	136 141 424
1905	116 835 050	2 866 263	2 235 936	121 937 249
1908	92 001 910	3 173 950	769 932	95 945 792
1909	70 564 927	3 271 312	335 343	74 171 582
1910	45 576 883	3 242 806	599 081	49 418 770
1911	56 068 607	3 805 918	417 577	60 921 102
1912	59 979 963	3 124 595	434 480	63 539 038
1913	36 212 190	2 476 654	521 533	39 210 377
1913*	15 522 804	1 144 707	370 993	17 038 504

* April-October.

The falling off in exports does not indicate a serious decline in the raising of hogs. According to the Census of 1891 there were that year on Canadian farms 1 733 850 hogs, which number had increased ten years later to 2 353 828, and in 1911 to 3 610 428.

Federal meat inspection in Canada, which is confined to establishments doing an export or inter-provincial trade, was inaugurated in September, 1907. The following table shows the number of hogs slaughtered in inspected establishments in Canada year by year since that time :

Swine Slaughtered in Canada at Inspected Establishments (1).

	Number
8 months ending March 31, 1908	861 989
Year ending March 31, 1909	1 532 796
" " " " 1910	1 261 496
" " " " 1911	1 452 237
" " " " 1912	1 852 997
" " " " 1913	1 607 741
10 Months ending January 31 1914	1 456 615

The decline in exports must, in large measure, be attributed to increasing consumption in Canada. During the years of heavy export the supplies shipped out were produced almost entirely in the Province of Ontario. The western provinces, while filling with people, were slow to produce hogs until the past two or three years, when a great increase in production has taken place. Up to 1913 packing houses in Ontario and Quebec had a large market west of the great lakes, but the tide has turned. Prairie province farmers, owing to continued high prices for pork, have turned their attention more and more to the feeding of hogs on their low grade and damaged grain, and since the fall of 1913 have been shipping hogs east in large numbers. During 1913 the slaughtering of hogs in Canada showed a very slight increase over that for 1912. The killings in eastern houses showed a decrease which was slightly more than met by an increase in the west. This is borne out by statistics supplied by the Meat Inspection Division of the Department of Agriculture in the following table.

Hogs Slaughtered in Inspected Houses.

	1913	1912	Increase or Decrease
Eastern Canada	923 908	1 058 486	— 134 578
Western Canada	336 147	145 064	+ 191 083

The exports of hog products from Canada have, until quite recently, been almost entirely to Great Britain. With the coming into force of the "Wilson-Underwood" Tariff in September, 1913, the markets of the United

(1) A large number of swine are slaughtered in Canada in places other than those under federal inspection.

States of America were thrown open to meat products on a free basis. Since that time increasing quantities of Canadian bacon, hams and pork have been finding their way over this international boundary.

Pedigree Registration.

The registration of swine in Canada commenced with the Berkshire breed in 1875, but it was not until 1882 that other breeds commenced to be recorded. That year, a record was opened for Suffolks, Yorkshires and Tamworths, and at various periods up to 1892 practically all of the present breeds in Canada, with the exception of the Hampshires, were being recorded; Hampshire records were opened in 1910. The work of registration was carried on by the Agriculture and Arts Association of Ontario until about the year 1900, when that body ceased to exist. From that time until the National Live Stock Records were formed in 1905 (under the Live Stock Pedigree Act of 1901) the work of registration was done by the late Henry Wade, Secretary of Live Stock Associations in Ontario.

Since 1905 the registration of swine in Canada has been carried on under the National Live Stock Records System at Ottawa.

The development of a Canadian "bacon" hog is strikingly reflected in pedigree registration. During the past thirteen years hogs of breeds of the "bacon" type have increased by leaps and bounds, those approaching that form have more than held their own, while certain breeds of the short, thick type have passed off the stage so far as registration in Canada is concerned. The following table shows the number of pedigrees of each of the several breeds that have been recorded up to 1900, the number of each recorded up to the beginning of 1914 and the number of each recorded since the beginning of the present century:

Pedigree registrations:

	Up to 1900	Up to 1914	No. since 1900
Berkshire	12 147	29 350	17 203
Yorkshire	6 681	46 393	39 712
Tamworth	2 398	10 063	7 665
Chester White	2 519	11 420	8 901
Duroc Jersey	706	2 363	1 657
Poland China	2 595	3 878	1 283
Hampshire	—	933	933
Essex	20	272	252
Suffolk	262	281	19
Victoria	14	—	—

Pure Bred Swine in Canada.

The following table compiled from Canadian Census returns of 1911 shows the numbers of pure bred swine in Canada, by provinces, in June of that year:

Breeds	Alberta	British Columbia	Manitoba	New Brunswick	Nova Scotia	Ontario	Prince Edward Island	Quebec	Saskat- chewan	Canada
Berkshire	1 771	342	1 995	235	187	7 455	246	740	918	13 889
Chester White	23	39	62	301	52	1 665	112	1 901	42	4 197
Duroc Jersey	214	2	33	—	12	436	1	22	10	730
Essex	—	15	—	—	—	31	—	—	—	46
Hampshire	2	70	20	1	—	664	4	153	2	916
Poland China	215	5	145	—	4	388	—	120	93	970
Suffolk	—	—	2	—	—	4	—	5	—	11
Tamworth ,	141	53	363	41	—	2 996	1	634	64	4 293
Yorkshire	2 120	386	2 385	775	353	15 459	603	4 013	1 635	27 729
Not specified	108	255	532	112	33	1 753	42	696	113	3 666
Total . . .	4 594	1 167	5 537	1 465	661	30 853	1 099	8 284	2 877	56 447

SECOND PART.
ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION.

AGRICULTURAL
EDUCATION

- 806 - Courses of Instruction for Teachers in Rural Continuation Schools in Prussia. — *Zeitschrift für das ländliche Fortbildungswesen in Preussen*, Year 5, Part 9, pp. 397-398. Berlin, June 1914.

Special courses were to be held this year in 19 places in Prussia for the instruction of teachers in rural continuation schools.

ORGANIZATION
OF EXPERI-
MENTAL AND
ANALYTICAL
WORK

- 807 - Recent Experience in Farming on Moors. — Communication from Dr. HJ. VON FEILITZEN, Director of the Experiment Station of the Swedish Moor Cultivation Association.

Among the recent works which deal with the nature of humic substances those of BAUMANN and GULLY, TACKE and SÜCHTING, RINDELL, ODÉN, SCHREINER (1), and SHOREY deserve to be mentioned, and on the chemistry of the nitrogen of moor soils the works of JODIDI, SUZUKI and VALMARI.

The formation of limonite and its explanation by AD. MAYER and RINDELL led to a closer discussion of HAGLUND's so-called fire theory and to the explanation of the origin of sphagnum moors through the destruction of the moor forests by fire (2).

On the growth of peat, recent investigations in Sweden have shown that in a moor 36 inches of peat have been formed since 1540. J. AF ZELLÉN measured in one locality a yearly increase of 1 inch of light sphagnum peat. According to TOLF this increase of peat on the surface of diggings has no practical importance.

Concerning the chemical composition of various kinds of peat the following works may be mentioned: ZALLER and WILK on pure sedge peat; GULLY on species of sphagnum and sphagnum peat; PAUL on the

(1) See No. 343, B. April 1913; also No. 311, B. April 1914.

(2) See No. 312, B. April 1914.

calciphobe nature of sphagnum; and MINNSEN on the various kinds of peat.

The writer's own investigations have shown that the moor water in untouched moors contains nearly one part of potash per 100 000.

As regards the microbiological properties of moor soils, KARSTEN at Helsingfors has recently made experiments on the low power of conducting heat of moor soils in a dry and moist state. Interesting also are the minimum temperature readings which have been taken during the last five years at Flahult 4 inches above the surface of the soil on different spots near each other, over sandy soils, fens, and cultivated and uncultivated moors, in the months from May to October. They show what considerable differences of temperature different irradiation of the soil causes in places quite close to each other.

Of great practical importance is the question of the draining of moor land. On the moor at Flahult shallow drainage with ditches 2 feet deep and 66 ft. apart, during five years, gave an average yield of hay 25 per cent. higher than that obtained from land drained by ditches 4 ft. deep. With shallow drainage the water-table stood, during the period of vegetation (May to October), at an average of 22 inches below the surface of the middle of the land between the ditches, while with the deeper drainage it stood at 26 inches. The fluctuations of the water-table were in general greater with shallow than with deep drainage.

In experiments made in concrete basins in the experiment garden, with constant heights of water-table (8, 16, 24, 32 and 44 inches), the grass crop in the first two years on sphagnum moor soil was highest when the water-table stood at 8 and 16 in. and decreased rapidly with the lowering of the water-table. On the fen land the crop was heaviest with the water-table at 16 and 24 inches.

In the second experiment farm at Torestorp, experiments have been in course for the last five years on the effect of varying distances (26, 40, 66 and 80 feet) between drains at equal depths (4 ft.). Hitherto no noticeable difference in the vegetation has been observed. The water-table stood everywhere about 36 inches below the surface. In this direction observations have recently been made also in Norway (Maeresmyren), Bavaria (Bernau) and Esthonia (Thoma).

On the importance of damming up the water in the ditches on moors American farmers in Michigan have collected evidence, and the Bremen Station recommends the practice in moor drains. Count BERG, at Sagnitz (Livonia), on the contrary, does not approve of it and recommends instead the use of heavy rollers to prevent the excessive drying of the surface of moor soil which has been rendered too loose by deep tillage.

The percolation of rainwater through well decomposed fen was found in lysimeter experiments at Jönköping to be 90 per cent. on bare soil in the winter half-year, and from 50 to 60 per cent on soil under vegetation. The corresponding figures were 40 and 10 to 30 per cent during the summer half-year.

For many years past a system of drainage has been practised in Sweden much resembling Butz' wooden pipe drainage (1); this latter system also has been used at Flahult with satisfactory results.

Experiments have been made during five years with lysimeters at Jönköping on the quantities of plant food carried away from moor soils by drainage water; they have shown that the losses on good fen land are much greater in uncultivated than in cultivated soil, and in arable soil than under meadows. More lime and nitrogen are lost by unmanured than by manured soils. In the case of potash the losses were about the same; only traces of phosphoric acid were found. The losses of potash caused by manuring amounted to from 2.23 lbs. to a maximum of 12.49 lbs. per acre per annum. The losses of lime reached 256 lbs. on arable land and 164 lbs. on meadows. A normal dressing of potash salts (38 per cent.) showed no increase of lime washed out over land without potash; this agrees with the Bromberg results.

The question of liming moors has been very exhaustively treated by DENSCHE (2) at Bremen and by SJOLLEMA and HUDIG (3). Dr. NILSSON-EHLE, of the Swedish Seed-breeding Station at Svalöf, has demonstrated that dry-spot disease (*Sclerotrichum*) (4) attacks the various kinds of oats with different intensity and that greater or less resistance is hereditary; of the varieties tested Improved Roslag and Mesdag were the most resistant, while Tartar Flagg and Improved Dala were very susceptible. According to Dr. HEDLUND, *Sclerotrichum* does not attack oats, and probably a saprophytic *Cladosporium* has been mistaken for it. The dry-spot disease, or "Kalimangelkrankheit" (disease due to lack of potash) as Dr. Hedlund calls it, is probably caused by soil bacteria, as the plants are not attacked by it when the soil has been sterilized, for instance with carbon disulphide.

That lime must be finely powdered in order to produce the best effects, has again been shown by recent experiments at Jönköping with powdered lime of several sizes of grain, in the course of which experiments the finest powder (passing through a sieve of less than 0.2 millimetre mesh) gave the heaviest yields (5).

Silicate of lime in Martin's slag proved almost equal to the carbonate.

Among new implements for use on moors (6), the most important are heavy cement rollers (7), motor ploughs, Banke's new Swedish meadow plough, Wassis and Hankimo Finnish harrows, the moor ploughs built by the Norrahammer factory and Faxé's moor shoes for horses.

Concerning manures it has been observed at Flahult that farmyard manure has a very feeble action during the first years of cultivation on

(1) See No. 229, *B.* March 1913 and No. 1324, *B.* Dec. 1913.

(2) See No. 1243, *B.* Nov. 1913.

(3) See No. 345, *B.* April 1913.

(4) See No. 575, *B.* June 1914.

(5) See also No. 17, *B.* Jan. 1914.

(6) See also No. 760, *B.* Aug. 1914.

(7) See No. 1067, *B.* Sept. 1913.

moor soils ; after some years its effect was decidedly better, but much inferior to that of artificials. On the peat soils of a better class the effect of farmyard manure was more marked. A shallow ploughing in to a depth of two to four inches was better than to a depth of six inches. It was found that for turnips it was better to apply farmyard manure in spring than in autumn. The spreading of road sweepings is recommended by SCHREIBER, and in Ontario, Canada, very good results appear to have been obtained by a cartload of garden earth to the acre. Green manuring with blue lupins gave very good results at Flahult ; the residual effect was, however, very slight.

Among the bacterial cultures on the market, Azotogen and Kühn's Nitragin in earth cultures have been beneficial on moor soils ; on the contrary liquid Nitragin proved uncertain. Earp-Thomas' Farmogerm (from Bloomfield, N. Y.) had very little effect on yellow lupins. Inoculation earth had a good and certain action.

The question of the effect of Leguminosae on Gramineae in mixed crops has been especially studied by TACKE, HILTNER, KASERER, LIPMAN, LYON, and BIZZELL.

The investigations of BOTTOMLEY on *Myrica Gale* deserve to be mentioned here.

HAGLUND, at the Jönköping Moor Experiment Station, tested the effects of artificials and lime on sphagnum and found that lime destroyed it ; basic slag acted like lime but less energetically. Superphosphate kills sphagnum. Kainit was somewhat caustic, but without any special effect, and nitrate of soda also acted weakly. The two latter, however, had an indirect action, as they encouraged growth of algae and lichens and thus hindered the formation of new shoots of sphagnum.

It is generally admitted that sedges dislike manuring, because the manuring of meadows causes them to disappear ; this is, however, not the case and the apparent destruction of sedges is only due to their being smothered by the other plants. GEZE, at Villefranche-de-Rouergue (Aveyron, France), has shown by direct manuring experiments, that sedges growing alone respond readily to phosphoric acid, nitrogen and potash.

At the Jönköping Moor Experiment Station experiments have been made for several years on the crops raised on the moors and on the quantities of plant food removed by them from the various moor soils ; two years ago the results were published in a voluminous report. There are some deviations from WOLFF's figures respecting certain plants, but in the main the values agree well with the revised figures given by STUTZER in *Mentzel & von Lengerkes landw. Kalender*. The writer's investigations did not allow him to confirm the high figures found by WAGNER and TACKE for the amount of phosphoric acid contained in hay ; the figures found by CHRISTENSEN in Denmark, LENDE NJAS in Norway, and KRÜGER and STUTZER in Germany, agree with those of the writer.

Among the different phosphates Palmaer phosphate proved equal to superphosphate. Basic slag was tested in two series of experiments,

and its total effect, lasting three or four years, turned out clearly superior to that of superphosphate. In the Danish field experiments superphosphate and basic slag proved of equal value on field crops, but on meadows the former was somewhat superior. The after effects of basic slag were better than those of superphosphate. In moist years basic slag acted better than in dry ones. Bone meal behaved almost as well as superphosphate on acid moor soils, but badly on alkaline soils. Tunis phosphates, on newly cultivated moor land at Mshult, in two years of experiment, gave only one half the effect of basic slag. Vivianite proved almost as good as basic slag.

As for potash manures, the effect of phonolite (1) was only half that of Stassfurt salts.

Among recent experiments those with "Elektrokali" (2) and Jungner's carbonate of potash, as well as those on the substitution of potash by soda, and the works of WHEELER, SCHULTZE, WOHLTMANN and SÖDERBAUM on the effects of common salt deserve to be mentioned.

CROPS AND CULTIVATION.

AGRICULTURAL METEOROLOGY

808 - **An Improved Co; Psychrometer.** — SHAW, H. B. (Bureau of Plant Industry, U. S. Dep. of Agr.) in *The Plant World*, Vol. XVII, No. 6, pp. 183-185. Baltimore, Md., June 1911.

A psychrometer (*i. e.* an instrument used by the U. S. Weather Bureau for measuring the relative humidity in given localities) is described which is designed for use amongst foliage and differs from other psychrometers in being provided with a protecting device preventing entanglement with the foliage while the thermometers are being whirled.

SOIL PHYSICS, CHEMISTRY AND MICROBIOLOGY

809 - **Distribution of Soil Particles.** — BEDFORD, DUKE OF, and PICKERING, S. U., in *Fourteenth Report of the Woburn Experimental Fruit Farm*, London, 1914.

The distribution of the clay particles in a soil was determined in a series of experiments, carried out during a period of 14 months, in order to estimate the influence of the rainfall on such distribution. From a plot of ground 4 yards square which had received moderate dressings of artificial manures for the last 18 years, samples were drawn once a month in three layers of 6 in. each down to a depth of 18 in. The samples were air-dried, sifted, and dried at 100° C.; then 40 gms. were shaken up with 400 cc. of water for 24 hours; after being allowed to settle, 200 cc. of the solution were syphoned off and its clay content was estimated. The results obtained for the top 6 in. of soil are given below, together with the rainfall for the 20-day period preceding each sampling:

(1) See Prof. LEMMERMANN's article, in *B.* Oct. 1913, pp. 1486-1489; also No. 253, *B.* March 1913 and No. 500, *B.* June 1914.

(2) See No. 420, *B.* May 1914.

(Ed.).

Month	Clay in uppermost 6 in. of soil		Rainfall during previous 20 days. in.
	per cent of soil. "Absolute"	per cent of total clay throughout the 18 in. of soil. "Relative"	
July 1911.	0.52	23	1.35
Aug.	0.31	9	0.48
Sept.	0.26	11	1.21
Oct.	0.38	21	1.36
Nov.	0.50	24	2.08
Dec.	0.47	18	1.49
Jan. 1912.	0.44	24	2.01
Feb.	0.56	29	1.70
March.	0.52	17	1.35
April	0.31	16	0.68
May	0.20	13	0.27
June	0.40	20	2.33
July	0.25	8	1.11
Aug.	0.46	18	2.65

The fluctuations in the "relative" clay content of the top layer of soil follow closely those of the rainfall except during the month of February when the land is in an abnormally wet condition owing to the accumulation of the winter rainfall. If the "relative" proportion of clay in the top 6 in. of soil be calculated on the two topmost layers alone, instead of on the whole depth of 18 in., then the figures, though following the rainfall fairly well, do not do so as well as when the proportion of clay in the topmost 6 in. of soil is considered in relation to the three layers; and from this it would appear that the effect of the rain on the clay particles extends below the top 12 in.

The total "absolute" amount of clay in the 18 in. is by no means constant; this would indicate that the alteration in the proportion of the clay in the uppermost layer is not due to differences of distribution, but rather to deflocculation and flocculation caused by the rain; on the other hand, as the "absolute" amounts of clay in the top layer do not follow the fluctuation of the rainfall as closely as the "relative" amounts, it would seem that though the flocculation and deflocculation are perhaps the most important effects of the rainfall, they are not the sole ones, and that some redistribution of the particles also occurs.

810 — **The Number and Growth of Protozoa in Soil.** — SHERMAN, J. M. (University of Wisconsin), in *Centralblatt für Bakteriologie, etc. II Abt.*, Vol. 41, No. 18/23. pp. 625-630. Jena, July 22, 1914.

Sixteen soils from Wisconsin, Virginia and Tennessee were examined for protozoa by the dilution method, soil extract being used as the growing medium. It appeared from the results that all the soils contained at least

1000 protozoa per gram and that most probably even 10 000 per gram would still be a conservative estimate. Nearly all the organisms found were flagellates, but *Colpoda cucullus* and *C. steinii* occurred in two of the $\frac{1}{1000}$ dilutions and *Balantiophorus elongatus* in one of them. No amoebae were found.

Sterilized soils were also inoculated with normal soil, proving good culture media even with a somewhat subnormal moisture content. After 15 days flagellates had multiplied in some cases to the extent of 100 000 per gram of sterilized soil; ciliates on the other hand made no growth.

811 - Relation of Bacterial Transformations of Soil Nitrogen to Nutrition of Citrus Plants. — KELLERMAN, K. F., and WRIGHT, R. C. (Bureau of Plant Industry, U. S. Dep. of Agr.) in *Journal of Agricultural Research*, Vol. II, No. 2, pp. 101-113. Washington, D. C., May 1914.

The writers analysed the soils of certain citrus groves suffering from chlorosis in California and carried out greenhouse experiments in Washington, D. C., from which they obtained evidence that the falling off in yield of the citrus groves may be due to the toxic effects of superabundant nitrates.

OPENING UP
LAND FOR
CULTIVATION

812 - Improvement of Waste Land in the Netherlands. — MÜLLER, A., in *Deutsche Landwirtschaftliche Presse*, Year XXXI, No. 57, pp. 701-702. Berlin, July 1914.

1. Generalities. — In the Netherlands the improvement of waste lands commenced in the first few decades of last century with the afforestation of heaths by individual landlords; some of these now form groups of fine closed woods. The growing interest in the improvement of unproductive lands led the parties concerned to the foundation of the Heath Improvement Society in 1888. At first the State limited its action to the encouragement of private undertakings and to the fixation of certain shifting dunes which were a menace to the community. It was only in 1899, after the institution of a special Forest Service, that the State began to purchase large extents of waste land and to put them under cultivation. It dealt chiefly with lands the improvement of which was important for the neighbouring cultivated areas but not suitable for private enterprise. At present the State Forest Service possesses 46400 acres of waste land and 12850 acres of cultivated land against 26 000 and 6600 in the year 1899. Further, the State assists the Communes in their work of improvement of waste lands by granting loans free of interest and by the technical direction of the work; the Heath Improvement Society also receives yearly State grants for the promotion of drainage schemes and for holding public courses in forestry.

2. Treatment of heaths. — *a) For permanent agricultural utilization.* — The first operation generally consists in working with a steam plough to a depth of 6 to 12 inches; occasionally in uneven soils the spade is used. Then follows manuring, for instance with 6 to 8 cwt. per acre of basic slag and kainit, and yellow lupins and serradella are sown for a year or two. According to position and soil, oats and rye or potatoes and even beets or peas are then grown. If the heath is suitable for meadow or pasture

the ploughing is only 6 or 8 inches deep and is followed by harrowing. After due drainage and levelling of the inequalities of the surface the soil is manured; moor soils are frequently covered with a layer of sand 2 to 4 inches deep; grass and clover are then sown, often under oats or rye, but sometimes after potatoes.

b) *For reafforestation.* — The areas suitable for forests are ploughed to a depth of about 16 inches, and where necessary drained by open ditches and manured with artificials and green manure crops (yellow lupins). They are then mostly put under rye for one or two years (sometimes seradella is taken with it) or, on low-lying land, under oats. After this preparation one-year-old pines are planted at distances of 24 to 30 inches each way. If the locality is suitable, oak, elm, alder and other trees are also planted in clumps or as borders.

3. *Fixation of shifting sands.* — While the heaths occupy about a million acres, the sands cover only about 125 000 acres. About seven-tenths of these are maritime dunes. Considering the importance of this area for agriculture, the State has taken possessions of four-tenths of the coast dunes and three-tenths of the inland ones. In the districts of Haarlem and the Hague some large dune areas have been afforested by private owners.

a) *Inland shifting sands.* — After roughly levelling the greatest inequalities of the surface of the sandhills the ground is partially or wholly ploughed to a depth of 12 to 20 inches. Then the soil is covered with cut heath, marram grass, peat or the like, on which a shovelful of sand is thrown at every step. Recently the areas to be afforested have been treated with various fertilizers, as well as with lupins, the straw of which has proved very useful for covering the soil. Two-year-old pines are then planted by means of iron planting-spades provided with a long and heavy blade which ensures the long pine roots reaching to the moist subsoil.

b) *Dunes.* — For fixing the dunes the Dutch use chiefly marram grass (*Ammophila arenaria*); plants preferably one or two years old are carefully dug out and planted in clumps at distances of 20 in. \times 20 in. (on slopes 12 in. \times 12 in.). As soon as the condition of the soil allows it, Austrian, Corsican and mountain pine are planted. In sheltered spots Scots pine is used with success, as well as pitch pine (*Pinus rigida*) and in some moist places oaks and alders. Where conditions are favourable the possibility of agricultural work is not neglected. Thus, for instance, on the island of Texel, where for a long time sheep breeding has been practised on a large scale (about 30 000 lambs are exported every year), the most sheltered dunes have been devoted to grazing purposes.

813 — **A New Way of Utilizing the Energy of Peat Beds.** — ZAILER, V. in *Zeitschrift für Moorkultur und Torfverwertung*, Year XII, Part 3, pp. 89-91. Vienna, 1914.

In order to utilise the quantities of energy latent in peat beds, the construction of large central electric stations has been undertaken. These works burn only dried peat. This is done in two different ways: the peat is either burnt directly in the fire-box of steam boilers and the steam is used to drive turbine dynamos, or it is burnt in gas generators and the gas used

in motors which transform the energy into electricity. Some of these generators obtain sulphate of ammonia as a by-product.

Of late another method has been adopted, to a certain extent combining the advantages of the two systems, and giving a still better utilisation of the energy contained in the fuel. This is the flameless surface combustion of generator gas under steam boilers. The process was invented at the same time in England and in Germany. It consists in leading a mixture of gas and air under low pressure through a certain mass of fuel which melts only at an exceedingly high temperature. In the interior of the mass an incandescent nucleus is formed which irradiates heat without forming flames. In England some boilers fired with this system have worked uninterruptedly for upwards of nine months, using water gas or coke gas. Any other similar gas can be used equally well. Whilst formerly it was considered satisfactory to produce 8 to 9 lbs. of steam from 1 sq. ft. of heating surface, with this method as much as 21.5 lbs. of steam can be produced from the same surface.

From the point of view of the exploitation of moors it is of great importance that no other fuel need be brought to heat the boilers.

The writer is of opinion that if this invention fulfils its promises a great step will have been made towards the solution of the problem of utilizing the energy latent in peat beds.

814 - Influence of Lime on Soil Bacteria. — MILLER, F., in *Zeitschrift für Gärungsphysiologie*, Vol. IV, Part 3, pp. 194-206. Berlin, April 1914.

The writer contributes to the discussion of the question already examined in various quarters as to the influence of the compounds of lime upon the multiplication and the vital activity of soil bacteria. In the experiments the rather heavy soil of the experiment field of the Agricultural and Bacteriological Institute of the University of Göttingen was used. The soil was taken from the field when it was damp; it was then sifted and thoroughly mixed. The additions were calculated on the dry earth. The quicklime was added in a finely pulverized state and well mixed with the soil. It contained only 4.16 per cent. of CO_2 . The soil under examination contained 2.02 per cent. of CaO and 1.19 per cent. of CO_2 . An addition of 5 per cent. CaO made the soil noticeably warmer and additions of 1 and 5 per cent. increased the loss of water from the soil. The experiments led to the following principal results:

1. Additions of 0.3, 0.5 and 1 per cent. CaO caused at first a striking decrease in the numbers of bacteria and later an immense increase. The greater the addition of lime the longer the duration of the decrease, but also all the more intense the increase when it finally set in.

2. The addition of 5 per cent. CaO hindered completely the growth of bacteria.

3. Quicklime in doses of more than 0.05 per cent. on loam rich in lime caused a reduction of nitrification. Doses of 0.01-0.06 per cent. in Bunter sandstone poor in lime have a stimulating effect in this direction.

4. Additions of quicklime up to 0.1 per cent. on sandy soils rich or

poor in lime diminished the formation of nitrate from ammonium sulphate, and doses of 0.5 per cent. CaO stopped this process altogether.

815 — Experiments on the Value of Nitrate of Guanidin and Nitrate of Urea in comparison with Nitrate of Soda and Nitrate of Ammonia. — WAGNER, P., in *Mitteilungen der Deutschen Landwirtschafts-Gesellschaft*, Year XXIX, Part 29, pp. 417-421. Berlin, July 18, 1914.

At the request of the German Agricultural Society's Committee on Manures the writer has tested the manurial value of nitrate of guanidin and of nitrate of urea, two new products derived from calcium cyanamide, which it is hoped can be placed upon the market at suitable prices. Samples of the two salts, the former containing 40.29 per cent. and the latter 30.54 per cent. of nitrogen, were obtained by the writer from the "Oesterreichischer Verein für chemische und metallurgische Produktion" of Aussig on the Elbe. The experiments were made on oats and French ryegrass.

1. *Experiments on oats.* — Fifty-two pots were used, each of them containing 46 lbs. of sandy soil of the following composition :

	per cent		per cent
Silt and clay	20.6	Carbonate of lime	0.02
Fine sand	19.4	Phosphoric acid	0.148
Coarse sand	50.1	Potash	0.076
Gravel	9.9	Nitrogen	0.079

TABLE I

No.	Manure	Dates of manuring			Total grams of nitrogen
		April 17, grams of nitrogen mixed with soil on sowing	May 21, grams of nitrogen dissolved in 1 litre of water and poured on soil	May 28, grams of nitrogen dissolved in 1 litre of water and poured on soil	
1	—	—	—	—	—
2	Nitrate of Guan'd'n	1.0	—	—	1.0
3		1.0	—	—	1.0
4		1.0	—	—	1.0
5		1.0	—	—	1.0
6	Nitrate of Urea	1.0	0.5	—	1.5
7		1.0	0.5	0.5	2.0
8		1.0	—	—	1.0
9	Nitrate of Soda	1.0	0.5	—	1.5
10		1.0	0.5	0.5	2.0
11		1.0	—	—	1.0
12	Nitrate of Ammonia	1.0	0.5	—	1.5
13		1.0	0.5	0.5	2.0

The four manures were given in doses of 1.0, 1.5 and 2.0 grams of nitrogen per pot. Each pot also received 5 grams of phosphoric acid under the form of basic slag, and 2 grams of potash as silicate of potash.

Table I gives the scheme of the experiment; Table II shows the results, expressed as average increase in dry matter over the average of the control pots, which was 20.2 gms. of straw and 6.2 gms. of grain.

TABLE II.

Nitrogen given under the form of:	Increase in yield of straw due to manuring with			Increase in yield of grain due to manuring with		
	1 gr N	1.5 gr N	2.0 gr N	1 gr N	1.5 gr N	2.0 gr N
Nitrate of soda . . .	86.9	104.1	113.4	46.3	70.8	76.7
» of ammonia . . .	85.7	101.9	100.0	42.1	64.7	71.8
» of urea . . .	62.2	81.8	97.1	37.8	54.8	67.2
» of guanidin. . .	33.6	—	—	26.8	—	—

Taking the yields obtained with nitrate of soda as 100, the following relative values are found :

	grain	straw
Nitrate of guanidin.	39	58
» urea	72	82
» ammonia	99	91
» soda	100	100

2. *Experiments with French ryegrass.* — For these experiments also 52 pots were used. The soil was the same as that for the experiments on oats. As basal manure 5 gms. of phosphoric acid as basic slag and 2 gms. of potash as silicate were mixed with the soil. To these amounts some more potash was added for the second cut and some phosphoric acid and potash for the third cut, so as to keep pace with the development of the plants. Three cuts were made. The manures under comparison were given as in the preceding experiment, but only to the two first cuts, the third getting no nitrogen.

The injurious effect of nitrate of guanidin observed in the experiment with oats was not noticeable in these tests. The sum of the average increases given by the three series (2, 3 and 4 gms.), expressed as dry matter in the three cuts, was as follows (control 18.3 gms.) ;

	gms
Nitrate of guanidin.	312.0
» urea	350.9
» soda	358.8
» ammonia.	365.1

If the increase obtained with nitrate of soda be taken as 100, the following relative values are obtained :

Nitrate of guanidin.	87
» urea.	98
» soda	100
» ammonia	102

The writer concludes from these experiments that nitrate of urea can be recommended to farmers as a useful manure, provided the nitrogen in it is sold at about 20 per cent. cheaper than the nitrogen in nitrate of soda. It does not seem advisable to produce nitrate of guanidin as a commercial nitrogenous manure, as its effect was inferior to that of the other three nitrates and in the experiments with oats it was observed that this nitrogen compound was not favourable to plant growth.

816 - The Relation of Atmospheric Evaporating Power to Soil Moisture Content at Permanent Wilting in Plants. — SHIVE, J. W. and LIVINGSTONE, B. E. (Botanical contribution from the John Hopkins University, No 37) in *The Plant World* Vol. XVII, No. 4, pp. 81-121. Baltimore, Md., April 1914.

AGRICULTURAL
BOTANY.
CHEMISTRY
AND
PHYSIOLOGY
OF PLANTS

In their investigations on the point of permanent wilting in plants, BRIGGS and SHANTZ (1) showed that the moisture content of soils where this point had been reached was the same when the experiments were carried out in a damp chamber or in an unshaded green-house. CALDWELL, on the other hand, only obtained moisture residues similar to those calculated from the Briggs and Shantz formula when he grew his plants in a moist chamber. The present investigations were undertaken to determine the effect of the evaporative power of the atmosphere on the soil moisture content at the permanent wilting point. To this end plants were tested under five different conditions of atmospheric humidity: a) in the open air, exposure I; b) in a cheese-cloth shelter, exposure II; c) in a lath shelter made of laths 3 cm. wide with 3 cm. spaces between the laths, exposure III; d) in a cheese-cloth shelter placed inside the lath shelter, exposure IV; and e) in a glass chamber protected from direct sunlight and kept saturated by wet cloths, exposure V. The evaporation rate in each exposure was determined by means of a porous cup atmometer. The experiments were carried out at the Desert Laboratory of the Carnegie Institute, at Tucson, Arizona, in July-September 1913. Maize, *Phaseolus vulgaris* and *Capiscum annuum* were used as test plants; the soils employed consisted of a mixture 25 or of 50 per cent. of a local clay loam with a coarse river sand, or of the clay loam used alone.

The results are summarised in the table on the next page.

These results confirm those of Caldwell in that the higher the rate of evaporation, the higher the water content of the soil at the wilting point. Where the soil employed consisted of a mixture of sand and loam the values actually obtained for soil moisture were all higher than those calculated from the Briggs and Shantz formula, but where the pure loam

Test Plant	Exposure	Evaporation from atmometer cc. p. hour.	Soil used	Water content of soil at the permanent wilting point		
				actual	calculated from Briggs and Shantz formula	ratio: actual calculated
Maize	V	0.3	25 % loam	4.30	3.80	1.13
	IV	1.5	75 % sand	5.48	"	1.44
	III	2.4		5.78	"	1.52
	II	3.0		6.04	"	1.58
	I	3.7		6.16	"	1.63
Phaseolus	V	0.2		4.70	"	1.25
	IV	2.3		5.36	"	1.41
	II	3.0		6.22	"	1.63
	III	3.6		5.73	"	1.51
	I	4.8		6.35	"	1.67
Capsicum	V	0.5		5.13	"	1.35
	IV	2.2		5.41	"	1.42
	III	3.2		5.85	"	1.54
	II	3.9		6.59	"	1.73
	I	6.1		7.17	"	1.88
Phaseolus	V	0.2	50 % loam	5.90	5.92	1.00
	IV	2.0	50 % sand	7.85	"	1.23
	III	3.3		8.16	"	1.37
	II	4.5		8.27	"	1.39
	I	5.8		8.37	"	1.41
Maize	V	0.1	100 % loam	10.99	12.52	0.88
	IV	0.6		11.89	—	0.95
	III	1.8		12.03	—	0.96
	II	2.6		12.95	—	1.04
	I	3.9		13.13	—	1.05

was employed the ratio actual: calculated started well below unity and only rose with increasing evaporation to a maximum of 1.05.

The writers discuss the interpretation of their results by means of a formula.

817 - The Distribution of Stomata in the Seedlings of Some Gramineae. — ZAEFFEL, EDOAR, in *Comptes Rendus hebdomadaires des Séances de l'Académie des Sciences*, Vol. 150, No. 2, pp. 205-207. Paris, July 13, 1914.

The writer has observed that in oats (*Avena sativa*) and in wheat (*Triticum vulgare*) the stomata are most numerous at the apex of the cotyledon, less numerous in the subapical belt and absent at the base of the cotyledon, while in *Panicum altissimum* and *Paspalum stoloniferum* stomata exist throughout the length of the cotyledon and are not more numerous towards the apex.¹

Summarizing, in the Gramineae examined, stomata are absent in the hypocotylous belt, which is incapable of heliotropic perception. In the cotyledon of oats and wheat stomata abound at the apex, where the heliotropic sensibility is great. Stomata exist also, though in much smaller numbers, in the subapical belt, which possesses only a weak capacity of perception. In the cotyledon of *Panicum* and *Paspalum* the stomata exist throughout the whole length, and the cotyledon is wholly sensible to light. The conclusion may therefore be drawn that in the Gramineae examined the abundance of stomata in young plants corresponds to their degree of heliotropic sensibility.

818 - The Resistance of Wheats to Winter (1). — HITIER, H., in *Journal d'Agriculture pratique*, Year 78, Vol. II, No. 29, pp. 82-84, Paris, July 16, 1914.

CEREAL AND
PULSE CROPS

Last winter M. Schribaux made observations on the resistance to cold of various wheats at the Paris Seed Trial Station and in the field devoted to collections belonging to the Agricultural Institute. The following points were noted.

The varieties from Algeria and the extreme south of France and the hard wheats (Touzelle de Provence and Richelle of Naples) were completely destroyed. Then follow in increasing order of resistance: wheat from the Gironde, Rieti, Belôtourka, Polish wheat, Black Russian Petanielle, Japhet, Bordeaux, Autumn Saumur, Saint Laud, Noé, Gros-Bleu and Pithivier (derived from Bordeaux). The hybrids Rieti × Japhet obtained by Schribaux proved decidedly less sensitive to the cold than their parents. Among the English wheats (which stood the winter well) Hunter's was the most resistant.

Among the rivetts, Nonette de Lausanne showed great resistance, but of all the wheats examined, Alsatian wheat and the hybrids obtained from it by M. Schribaux (Red Alsatian × Bordeaux and Red Alsatian × Dekat, varieties which are now well fixed) are those that stood the cold best.

According to observations in several parts of France, M. Hitier believes that the damage done to the wheat by frost depends more upon the nature and physical condition of the soil than upon the varieties of wheat used. In heavy soils which had been beaten down by rain all the varieties suffered, while they resisted in permeable soils and in those that had not been compressed.

The greater susceptibility to damage by frost cannot always be attri-

(1) See also No. 620, B. July 1914.

buted to late sowing, because in several cases the last wheats sown resisted much better than those sown first. On one farm in the department of Aisne and on another in Seine-et-Oise, it was observed that wheat overtaken by frost before it had completely sprouted out of the soil, grew very vigorously as soon as the thaw set in and did not suffer any further injury from the winter. Similar observations were made by M. Schribaux in 1891 and by others also.

It seems that there is a critical period in which wheat is specially susceptible; it is when the radicle is ceasing activity and the adventitious roots have not yet had time to develop; the result is a want of moisture in the leaves.

It may be said, in conclusion, that a whole series of causes exists, which we do not yet know completely and which render a wheat resistant or not to cold.

819 - Report on the Field Trials with Barleys organized in 1913 by the Barley-rowing Station of the Brewers' Institute of Berlin. — VON ECKENBRECHER, C., in *Deutsche Landwirtschaftliche Presse*, Year XXXXI, No. 50, pp. 625-628. Berlin, June 24, 1914.

The comparative trials carried out in 1913 by the Barley-growing Station of the "Versuchs- und Lehranstalt für Brauerei" were intended to test the cultural value of various barleys for brewing purposes. They were made on 14 farms in North Germany, with the six following varieties:

1. Bethge's No. 2.
2. Mahndorf Improved Hanna (Strain C 8).
3. Heil's Improved Franconia.
4. Zeiner's Improved Franconia.
5. Ackermann's Improved Lower Bavarian "Danubia".
6. Ackermann's Improved Lower Bavarian "Bavaria".

Each variety was grown on at least two plots separated by plots under other varieties. No special manure was prescribed; in general, however, abundant quantities of potash and phosphoric acid were used with more moderate dressings of nitrogen. The seeds used were obtained direct from the breeders.

The examination of the product was restricted to the following points: protein content of the dry matter, thousand-grain weight, and grading of the grain. The judges adopted the scoring usually followed in the Berlin barley shows: protein content, weight and uniformity, ranging from 1 point (bad) to 18 (superfine). The nature of the husk and the colour of the grain were also judged, 9 points being the maximum for the former and 5 for the latter.

The results of nine complete trials may be summarized as follows:

The highest average yield of grain was given by Zeiner's Improved Franconia, with 3130 lbs. per acre, but it was rather subject to smut and liable to lodge. It was followed by Ackermann's Danubia (very resistant to smut, but liable to lodge) with 3105 lbs. per acre, and by Bethge's No. 2 (little subject to smut but a little inclined to lodge) with 3095 lbs. per acre. The fourth place was taken by Heil's Improved Franconia with 3040 lbs. per

acre ; this suffered much from smut but stood up well. Ackermann's Bavaria, with 3030 lbs. per acre, possessed great resistance to smut and did not lodge. Last of all was Mahndorf Hanna, which yielded 2945 lbs. per acre ; it was fairly resistant to smut but liable to be badly laid.

The points awarded to the above varieties for brewing quality were as follows :

Zeiner's Improved Franconia	60.1
Mahndorf Hanna	58.9
Heil's Improved Franconia	58.4
Ackermann's Bavaria	57.3
Ackermann's Danubia	54.4
Bethge's No. 2	54.3

820 - **Field Trials of Vegetables: Four Years' Trials of Green Peas, 1909 to 1912.** — SCHULTZE, W. — *Arbeiten der Deutschen Landwirtschafts-Gesellschaft*, Part 253, 69 pp. Berlin, 1914.

The four years' field trials of green peas (1909-12), carried out on several experiment fields in the most important vegetable-growing districts in Germany, were intended to test the respective merits of the various kinds of peas as raw material for the canning industry, especially from the farmer's point of view. Special importance was attached to the time of ripening, to its duration, and to the stature of the plants, as dwarf varieties that do not require staking are to be preferred for the smaller amount of labour and material they require. Consequently early-maturing dwarf varieties were tried side by side with late-maturing tall ones. The preparation of the soil, sowing and cultivation were in every case carried out according to local practice.

Results. — The yields of green peas are subject to much greater variations than those of cereals or hoed crops. These variations are due partly to differences in soil and weather conditions and partly to the varieties of peas grown. In the eleven varieties tried there were striking differences in stature, time of ripening and quality of the crop, so that in certain cases it was difficult to decide which to prefer, as frequently a drawback in one point was compensated for by an advantage in another. Some varieties, however, possess a decided superiority, as may be seen from the following :

1. *Monopol*: plant of low growth (does not require staking), early ripening ; yield barely medium ; ratio of the weight of the seeds to that of the hulls good ; size of the peas good (the peas are sorted by two sieves, one of 7 mm. and the other of 8 ½ mm. mesh ; the larger peas are not esteemed for canning purposes).

2. *Stanley*: a marrowfat pea of low growth, very late ; yield and ratio of peas to hulls low ; small peas too numerous.

3. *Express*: medium growth, very early, medium to good yield ; satisfactory ratio of peas to hulls ; size of peas satisfactory.

4. *Ueberreich*: medium to tall growth, early, low yield ; medium ratio of peas to hulls ; size of peas unsatisfactory.

5. *Canning*: marrowfat pea, medium growth, late, low yield ; good ratio of peas to hulls ; small peas too numerous.

6. *Buchsbaum-Schnabel*: dwarf, very late, good yield, medium to good ratio, very good size.

7. *William Hurst*: marrowfat pea, low growth, early, low yield, good ratio, unsatisfactory size.

8. *Moringia White (Tentonia)*: marrowfat pea, low growth, very late, good yield, medium to good ratio, size poor; very good for drying.

9. *Moringia Green*: marrowfat, medium growth, late, medium yield, good ratio, poor size.

10. *Grünbleibende Folger*: tall, mid-season, good ratio, average size.

11. *Improved Schnabel*: tall, mid-season; yield, ratio, and size all very good.

From the above it is evident that there are dwarf varieties that yield well and possess a good ratio and well formed peas. In general the early varieties have lower yields than the mid-season and late ones, but they are less exacting as to soil and moisture. Owing to their shorter life the moisture they require when sown early is generally provided by the winter rainfall, which is not the case with later varieties, the yield of which is often endangered by dry weather, especially on light soils. The chief aims of practical plant breeding are thus seen to lie in the direction of combining early maturity with satisfactory yield.

The flavour of the peas is less dependent upon the variety grown than upon the weather and perhaps the soil and its state of cultivation.

FORAGE CROPS.
MEADOWS
AND PASTURES

821 — Physiological Correlations and Climatic Reactions in Alfalfa Breeding. —

FREEMAN, G. F. (Agricultural Experiment Station, Phoenix, Arizona) in *The American Naturalist*, Vol. XLVIII, No. 570, pp. 353-368. Lancaster, Pa., June 1914.

During the season of 1910, 44 varieties of alfalfa were grown at the Arizona Experiment Station Farm; they were irrigated at the rate of over 6 in. of water for each cutting, and 6 cuttings were obtained during the season; these were studied with regard to yield and character of the hay and other points.

The correlation between the yield obtained at the first and subsequent cuttings takes the form of a curve beginning and ending high with a sag in the middle, which indicates the presence of some disturbing factor specially noticeable at the fourth and fifth cuttings, and which appears to be the high temperature together with a slight deficiency of water. The presence of this factor is again evident in the disturbance of the normal correlation between the yield and the stand (number of plants on a unit area) at the fourth and fifth cuttings.

The 44 varieties are classified according to their morphological characters and geographical origin into the following groups: Mediterranean, Peruvian, European, American and Turkestan. The reaction of the different groups to the climatic conditions of Arizona is shown by plotting the differences between the average yield of each group and the total average yield at each cutting. The curves thus obtained show that there is a marked similarity between the European and Mediterranean alfalfas, though the better stand of the European varieties makes the yield always better than the yield of the Mediterranean ones; European varieties yield

their largest relative crops at the fourth cut and then go off rapidly. The curves of the American and Turkestan groups are again much alike, the Turkestan being slightly above the American strains; the yields of both groups decrease earlier than the European varieties. The Peruvian group on the other hand are by far the best croppers at the end of the season.

Other correlations show how the nitrogen content of the hay is dependent on the high proportion of leaves in the hay and on the composition of the leaves, but that the stand of the plant has no effect on the proportion of leaves in the hay, though this is always low when the plants are tall or when the total yield of hay is high. Negative correlation was also shown to exist between the height of plants and their stooing capacity (average number of stems per acre).

822 — **The Value of Turkestan Lucerne.** — BOHUTINSKY, G., in *Monatsheft für Landwirtschaft*, Year VII, Part 3-4, pp. 73-81. Vienna and Leipzig, 1914.

Owing to the increasing importation of Turkestan lucerne seed into Croatia, comparative tests were made in the experiment field of the Royal Agricultural College at Krizevci between this seed and the Hungarian, which is the most important in Croatia. The soil is a heavy loam, containing from 0.4 to 0.9 per cent. of lime; owing to its tenacity and capacity for water and to the abundant rainfall it is not the most suitable for growing lucerne. Nevertheless lucerne persists for five or six years, yielding from three to five cuts per year on land subjected to garden cultivation during the few preceding years, as was the case with the area on which the experiment was conducted.

Each variety of seed was examined as to its germinating capacity and then sown at the rate of 45 lbs. per acre on two plots each measuring 459 sq. yds. As a cover crop a thin sowing of four-rowed barley was made. The barley was sown first; then the land was thoroughly harrowed and on April 8, 1909, the lucerne was sown. It came up well on the 14th. The growth of both kinds was normal and when the barley was harvested on July 18 they did not differ from each other in appearance. Only later, on both plots, the Hungarian lucerne grew more rapidly and intensely and already in the first year yielded a considerably heavier crop than the other variety.

The experiment was continued during the three following years. Owing to the slower growth of the Turkestan lucerne the plots under this variety showed the very first year many more weeds than the other ones. The two varieties passed the winters 1909-10 and 1910-11 equally well, but during the winter 1911-12 the Turkestan lucerne, which was already very thin towards the end of 1911, fell off further. In the spring of 1913 it was so thin that the plants could have been counted. On the other hand the Hungarian lucerne presented a completely closed surface.

In 1910 the first cut was made on both varieties at the same time, the succeeding two cuts when each variety was in bloom. The yield was about equal, especially because the weeds also contributed to increase the bulk of the Turkestan plots, and also because the first cut was somewhat

too late for the Hungarian variety. In 1911 the cuts were made when this lucerne began to bloom; the result was that it gave five cuts with a considerably heavier yield than the Turkestan, which allowed of only four cuts. In 1912 both varieties were cut four times. The first cut of Turkestan, owing to the grass and weeds it contained, was more abundant than the Hungarian. In the other three cuts only the lucerne plants were weighed; in the second cut the grasses and weeds made nearly half. On the whole the yield of the Hungarian lucerne during the four years exceeded that of the Turkestan by 53 cwt. per acre, notwithstanding the fact that in the latter grasses and weeds were included except for the last three cuts of 1912.

The chief result of the experiment was the demonstration of the much slower aftergrowth of the Asiatic variety. The writer does not draw any conclusion regarding its shorter duration, as its slower growth favours the development of other grasses and this fact alone may lead to the earlier disappearance of the lucerne. Its slowness of growth is alone enough to condemn it as unsuitable for leys.

In order to prevent the trade in this variety, the writer proposes that the seller should be always obliged to declare the origin of certain inferior varieties and that the seed control stations should no longer seal the sacks containing it: the Hungarian stations have since 1909 stopped sealing the packages of this variety and have succeeded in the object aimed at.

SUGAR
CROPS

823 - Connection between Available Space, Weight and Sugar Content of Beets and Mangolds. — MUNERATI, O., MEZZADROLI, T., and ZAPPAROLI, F. V., in *Bollettino dell'Associazione Italiana delle Industrie dello Zucchero e dell'Alcool*, Year III, No. 1, pp. 6-12. Bologna, April 1914.

In the experiments conducted during 1912 and 1913 three groups were formed: one consisted exclusively of sugar beets, the second of mangolds and the third of a mixture of the two. They were sown in a field and in boxes 6 ft. 6 in. square by 3 ft. 3 in. deep containing different kinds of soil. The seeds were all of the same kind, and were sown on the same day. The results are summarised as follows:

1. Between the available space for each plant and the weight of individual beets there is no constant connection. While usually beets with plenty of available space are larger, yet very fine beets are also found where the plants are close together, and the reverse also is often the case.

2. The weight which some beets attain depends markedly upon the soil and, in equal soils, upon the season.

3. Exceptionally large beets occur much more seldom when they have much available space upon poor soil than upon a rich one.

The above observations are equally true for beets, mangolds, and semi-sugar beets.

4. Mangolds growing near beets do not affect the development of the latter.

5. Even in the most uniform soil imaginable (such as that in the boxes) and with the same treatment, the same variations and differences occur.

6. The differences between individual plants growing in the same

conditions of soil appear also in the shape of the roots and behaviour of the tap-root.

7. Even in sugar content noticeable differences are observed in beets growing in the same soil. Not only does the percentage of sugar vary according to the weight and form of the roots, but beets of the same weight and form and growing in the same soil during the same period may present very remarkable differences in the percentage of sugar they contain.

824 - **Coffee Cultivation in Uganda.** — SMALL, W. (Department of Agriculture, Uganda) in *Bulletin of the Imperial Institute*, Vol. XII, No. 2, pp. 242-250. London, April-June 1914.

Coffee is the staple crop of European planters in Uganda; exports have risen from about 10 tons in 1908 to 167 tons in 1912-1913, and are still rising as the estates gradually come into bearing; the exports for the 9 months ending December 31, 1913, were double those for the whole preceding year. There were 4 568 acres under coffee and 2 659 acres under rubber and coffee in March 1913.

The indigenous coffee plant is *Coffea robusta*, but this is only cultivated by the natives and consumed locally; Europeans plant the so-called Nyasaland and Bourbon varieties, said to have been imported from Jamaica and Aden respectively and both derived from *C. arabica*. Little care has been taken so far with seed selection, but both these varieties thrive well and yield heavy crops the fourth year. The outbreak of coffee leaf disease at the end of 1912 and the epidemic in 1913 led planters to give some attention to other forms of coffee, and experiments are now being carried out with *C. liberica*, *C. stenophylla* and *C. robusta*. With regard to climate, soil and altitude, Uganda is eminently adapted to the production of coffee.

The question of permanent shade in coffee plantations is still in the experimental stage; results obtained up to the present have not been favourable to permanent shading, but the matter has not yet been given a sufficiently extensive trial. The silky oak (*Grevillea robusta* A. Cunn.) is being tested for this purpose and various species of Leguminous trees, also para rubber trees which have the advantage of being profitable and the disadvantage of being subject to a root disease which also attacks coffee. The question of cover crops is also being investigated.

The strong, steady winds which occur periodically in certain parts of the country have to be guarded against, and high or low wind belts can be made with various trees, bananas being a favourite subject as they provide food for the native population at the same time.

Hemileia disease is endemic in Uganda and its appearance in the form of an epidemic in 1913 may be attributed to the fact that it was suddenly provided with a new host plant; despite the prevalence of this disease, the outlook is favourable, for the indications are that its virulence will be less in the future than in the past; the fungus, being endemic in Uganda, cannot be expected to work the havoc that it has wrought in other countries into which it was introduced. Planters are recognising that much depends on their efforts to eradicate it, and the Department of Agriculture is alive

STIMULANT,
AROMATIC,
NARCOTIC AND
MEDICINAL
CROPS.

to the situation. In dealing with white ants (termites), exterminators have been used with success. The ravages of these pests are unequal, and in some parts they have caused little or no damage to growing plants.

825 — **Production of Vanilla in the French Colonies.** — *Ministère des Colonies, Bulletin de l'Office Colonial*, Year 7, No. 77, pp. 200-249. Milan, May 1914.

Martinique. — Vanilla was introduced into this colony a long time ago (about 1697), but its cultivation has not spread much and it seems at present to remain stationary. During the four years from 1908 to 1911 the greatest exportation took place in 1909 (4 590 lbs., worth about £1520), the least in 1911 (2536 lbs., worth about £955).

Guadeloupe. — *Vanilla planifolia* was introduced in 1701; artificial pollination was begun in 1839, and a few years later the exportation of vanilla began; in 1911 it amounted to 39 267 lbs., of the value of £13 352. The greatest quantity was exported in 1908: 68 242 lbs., worth £10 871. Besides Mexican vanilla (*V. planifolia*), the native vanilla (*V. pompona*) is also grown to some extent.

Guiana. — *Vanilla planifolia* was introduced about the year 1870 by the Administration of the penal settlement, but it did not gain a footing and its cultivation is now abandoned.

Gaboon. — The cultivation of *V. planifolia* has developed gradually during the last fifteen years. The vanilla exported in 1911 was 891 lbs., worth about £1102. Vanilla has often been found wild in both the French and Belgian Congo.

Mayotte and dependencies. — Vanilla has been cultivated in the Comoro Islands since 1875. At present it is the principal crop of the archipelago; in 1909 the crop amounted to 91 525 lbs. The greatest quantity is produced by the island of Anjouan (1 200 000 plants); the quantity harvested in 1908 was 59 342 lbs., worth £32 031; the island of Mohéli gives the best quality. Mayotte possesses about half a million plants.

Madagascar and neighbouring islands (1). — Vanilla is not native to the island, but it is now widely spread, especially along the east coast. The neighbourhood of Tamatave seems to be too moist for *V. planifolia*, but might perhaps be suitable for other species. In 1891 there were already at and round Vatomandry about 181 000 plants, and during the last twenty years this crop has attained real importance in the island, especially in the provinces of Vohemar and Antananarivo, in the districts between Andevoranto and Mananyari. In Madagascar it does not encounter any serious natural obstacles, but the market is limited and the island is near other competing centres of production, such as Réunion and the Comoro Islands, the plantations of which are in full bearing and producing a vanilla which enjoys great repute. The exports began to be important in 1896; in 1911 they reached 115 589 lbs., worth £87 452. The vanilla of Nossi-Bé is especially renowned, but, like all Madagascar vanillas, is somewhat lacking in perfume.

Réunion. — Vanilla has been grown in this island for about a century,

(1) See also No. 635, B. July 1914.

and it has also been exported for a long time, but it was only after 1862 that exportation became considerable. The so-called "vanillon" (the exportation of which began in 1884) is not *V. pompona* but the pods of *V. planifolia* less than 5 ½ inches in length. The cultivation of vanilla is somewhat decreasing in Réunion, but the island still occupies one of the foremost positions among the countries producing this commodity. Almost the whole of the crop is exported. The graph of the exports from 1896 to 1911 presents two maxima, in 1898 and in 1902, respectively 442 046 lbs., worth £273 057, and 439 526 lbs., worth £107 196; in 1911 it was 146 610 lbs., worth £73 606.

Bourbon. — Vanilla is grown almost everywhere up to 100 ft. above sea-level; it thrives better, however, in the windward part of the island than in the leeward. Bourbon vanilla ranks in the trade as a vanilla having a strong perfume, while in Mexican vanilla the perfume is delicate and sweet.

New Caledonia. — It appears that vanilla was introduced about 1861 and that only parts of the island are suitable to its cultivation. Experiments carried out on medium soils in the neighbourhood of Nouméa gave good results, but then the introduction of coffee raised more interest and vanilla was abandoned. In 1901 234 lbs., worth £127, were exported, but in 1911 only 2 lbs.

Tahiti. — *V. aromatica* was introduced in 1848 and is now widely spread. It is grown chiefly by the natives; the pods are picked too soon and their preparation leaves a good deal to be desired; the result is that the produce is sold at a low price, chiefly to Germany and the United States. In 1902, 318 525 lbs. were exported, representing a value of £47 493; in 1903, 289 761 lbs., worth £23 461. After 1904 the exports from Tahiti are included in those from Oceania, which comprises Tahiti and Moorea. In 1911 it amounted to 467 567 lbs., worth £95 944.

French establishments in India. — At Pondicherry vanilla was introduced into the botanic gardens of the colony about 1879. The production began to be regular after 1888; it reached a maximum in 1901, with 280 lbs., worth £175. The soil and climate of the French establishments in India are not suitable to this crop, and the prices realized are not sufficiently remunerative.

Indo-China. — Vanilla was introduced about 1865 to the botanic gardens of Saigon, but it has not gained a footing in the country.

The exportation of vanilla from all the French colonies amounted in 1911 to 948 988 lbs., worth £389 832. The French colonies produce about two-thirds of the vanilla produced in the whole world. Its consumption in France between 1907 and 1912 was about 132 300 lbs. per annum.

826 — Nicotine in the By-products of the Cultivation of Tobacco (1). — CHUARD, E., and MELLER, R., in *Compte-rendus hebdomadaires des Séances de l'Académie des Sciences*, Vol. 159, No. 2, pp. 208-209. Paris, July 13, 1914.

Through the investigations carried out by the writers, in 1911, into the variation of the proportion of nicotine in the several organs of the

(1) See No. 1424, B. Oct. 1912.

(Ed.).

tobacco plant during the course of development, it was ascertained that the offal of the crop as it is raised in Switzerland contains considerable quantities of the alkaloid. This waste consists of tips and axillary shoots before the leaves are gathered; stems, roots and shoots after the leaves are gathered. This waste, when used green, in order to avoid the loss of nicotine due to esiccation, is an important raw material for the preparation of the titrated solutions used as insecticides.

Experiments were undertaken in 1913 with a view to ascertaining the possibility of increasing the yield of nicotine in these waste products by suitably modifying the methods of cultivation of the plants and their treatment after the leaves had been gathered, without damaging the quality and the quantity of the chief product; the following methods were tried: 1) allowing the axillary shoots to grow instead of removing them as they appeared; 2) at harvest time gathering only the largest leaves, leaving in the ground all the stems provided with the recently formed shoots; 3) treating with nitrate of soda the plants thus partially deprived of their leaves.

From the analysis of the plants thus treated the writers draw the following conclusions:

1. The plants not deprived of their shoots are on the whole less abundant producers of the alkaloid (1.305 gm. nicotine per untouched plant against 1.891 gm. in the others), and this independently of the serious harm done, by not removing the shoots, to the quantity and quality of the main crop.

2. The yield of nicotine of the plants left in the field after the harvest with the small shoots recently formed in the axils of the large leaves is much superior (0.942 gm. nicotine per whole plant against 0.432 gm.) to that of the plants completely stripped.

3. Treating with nitrate of soda does not regularly modify the relative content of the different organs of the plant, but increases the absolute production of alkaloid per individual by favouring its growth (with nitrate 0.739 gm. nicotine per completely stripped plant and 1.288 gm. per partially stripped one). Thus nitrate is not a direct producer of nicotine (A. Mayer).

The writers conclude that it would not be advantageous, even from the point of view of the production of nicotine, to allow the growth of the axillary shoots which are formed before picking, instead of removing them as they appear, but that the returns from the utilizable by-products (according to the method of cultivation adopted in Switzerland) may be considerably increased by giving nitrate of soda to the plants that are left standing after the harvest, during which they are deprived only of their large leaves.

827 - **Experiments in Growing Medicinal Plants at Korneuburg in 1913 (1).** — (Communication of the National Committee for the Encouragement of the Cultivation of Medicinal Plants in Austria, No. 17). SENFT, E. in *Zeitschrift für das Landwirthschaftliche Versuchswesen in Oesterreich*, Year XVII, Part 3-4, pp. 129-182. Vienna, March-April 1914.

After some general observations on the cultivation of medicinal plants in Austria and on their disposal, the writer enumerates the chief pests which attacked them in 1913. Thus it is remarkable that white grubs attacked almost all the poisonous and aromatic plants, such as *Atropa*, *Hyoscyamus*, *Datura*, *Angelica*, *Valeriana*, *Anacyclus*, *Pyrethrum* and others, and respected only *Conium* and *Levisticum*. He then gives detailed information on the sowing, manuring (in some cases), development, pests, harvest and yield of the following plants: marsh mallow (*Althaea officinalis*), hollyhock (*Althaea rosea*), pyrethrum (*Anacyclus officinarum* and *Anacyclus pyrethrum*), annual and biennial angelica (*Angelica archangelica*), *Anthemis nobilis*, wormwood (*Artemisia Absinthium*), estragon (*A. Dracunculus*), deadly nightshade (*Atropa Belladonna*), blessed thistle (*Cnicus benedictus*), Caucasian pyrethrum (*Chrysanthemum [Pyrethrum] carneum*), Dalmatian pyrethrum (*Chrysanthemum cinerariaefolium*), scarvy-grass (*Cochlearia officinalis*), foxglove (*Digitalis purpurea*), yellow gentian (*Gentiana lutea*), *Grindelia robusta*, *Gypsophila paniculata*, *Hydrastis canadensis*, henbane (*Hyoscyamus niger*), hyssop (*Hyssopus vulgaris*), elecampane (*Inula Helenium*), German iris (*Iris germanica*), lavender (*Lavandula Spica*), lovage (*Levisticum*), liquorice (*Liquiritia*), mallow (*Malva sylvestris*), balm (*Melissa officinalis*), mints (*Mentha canadensis*, *M. crispa*, *M. viridis*), peppermint (*M. Piperita*), marjoram (*Origanum vulgare*), *Panax quinquefolium*, opium poppy (*Papaver somniferum*), parsley (*Petroselinum sativum*), rhubarb (*Rheum*), rue (*Ruta graveolens*), sage (*Salvia officinalis*), sclary (*Salvia Sclarea*), soapwort (*Saponaria officinalis*), comfrey (*Symphytum officinale*), tansy (*Tanacetum vulgare*), thyme (*Thymus vulgaris*), valerian (*Valeriana officinalis*), mullein (*Verbascum phlomoides*).

The number of species planted in the botanical garden during the year 1913 was 140. Among them there are some North American medicinal plants which thrive well, especially *Spigelia marylandica*, *Asarum canadense*, *Hamamelis virginiana*, *Grindelia robusta* and *Hydrastis canadensis*.

828 - **The Influence of Soil and Manures on the Yield, Chemical Composition, Size and Quality of Strawberries.** — VERCIER, J., in *Journal de la Société Nationale d'Horticulture de France*, Vol. XV (4th Series), pp. 349-375. Paris, May 1914.

FRUIT
GROWING

Plant food removed by strawberries. — This was estimated not only in the fruit harvested during one season but also in the vegetative organs of the plant representing one year's growth; the following results were obtained (Table I):

(1) See also No. 1155, B. Oct. 1913; No. 1345, B. Dec. 1913; and pp. 26-30, B. Jan. 1914, article by Dr. BÉLA PÁTER: Cultivation of Medicinal Plants in Hungary. (Ed.)

TABLE I. — *Removal of plant food from the soil by strawberries (lbs. per acre).*

	Total crop		Nitrogen	Phosphoric acid	Potash	Lime and Magnesia
	Green	Dry				
<i>Removed by fruit, including calyxes and peduncles :</i>						
in 10 English varieties	13 400	4 800	45.32	41.46	43.40	22.18
(composition per 100 parts green weight).			(0.338)	(0.310)	(0.324)	(0.166)
in Alpine varieties	10 700	5 600	86.36	51.26	85.80	35.10
(composition per 100 parts green weight).			(0.806)	(0.478)	(0.801)	(0.328)
in 3 perpetual-fruited varieties	13 800	7 200	90.00	46.78	93.55	34.55
(composition per 100 parts green weight).			(0.650)	(0.338)	(0.676)	(0.250)
<i>Removed by vegetative organs :</i>						
in 10 English varieties	3 200	1 200	13.91	11.80	13.67	45.98
(composition per 100 parts dry weight).			(1.17)	(1.00)	(1.15)	(3.87)
in Alpine varieties	1 200	500	9.28	5.46	4.81	12.70
(composition per 100 parts dry weight).			(1.83)	(1.08)	(0.95)	(2.51)
in 3 perpetual-fruited varieties	2 400	1 060	13.90	0.90	7.54	29.46
(composition per 100 parts dry weight).			(1.30)	(0.85)	(0.71)	(2.78)
<i>Total removed by crop :</i>						
in English varieties			59.23	53.26	57.07	68.16
» Alpine »			95.64	56.72	90.61	47.80
» perp. fruited »			103.90	47.68	101.09	64.01

The figures for phosphoric acid are relatively high, as the soils of the experimental fields were rich in this element.

The effect of manures. — The effect of different manures on the size of the fruit was investigated on various soils; the results are given in Table II.

TABLE II. — *Average weight of strawberries (Sharples) in grams.*

Soil	Control	Complete manuring	No potash	No nitrogen	No phosphoric acid	Slag alone	Potash alone	Organic manures
A	10.5	10.7	—	10.5	—	—	—	—
B	10.4	—	—	—	—	10.6	—	—
C	6.4	9.2	—	—	—	—	7.5	—
D	9.5	9.6	11.8	9.4	10.1	—	—	12.5
E	—	—	—	—	—	—	9.4	9.7
F	8.3	8.6	—	—	—	8.3	8.9	9.3

The influence of manures on the period of ripening was also examined, but though manured plots in general may be said to ripen earlier than unmanured plots, the various manures produced very irregular effects in this connection.

The influence of manures on the flavour of the fruit is given in Table III:

TABLE III. — *Influence of manuring on flavour of strawberries.*

Manurial treatment	Points	Remarks
I Unmanured	80	Typical flavour.
II No nitrogen, but slag and sulphate of potash	60	Flavour reduced, not so sweet.
III Complete manuring, slag, sulphate of potash and nitrate	63	Flavour reduced, very slight acidity.
IV No potash, but slag and nitrate	93.5	Very fine flavour, large fruits.
V No phosphoric acid, but sulphate of potash and nitrate	75.5	Fairly sweet and with a pleasant taste.
VI Organic manure: compost, blood and cake residues	79	Fruit well filled and with a pleasant taste.

Though the absence of potash raises the quality of the fruit, it also decreases the total amount of the crop.

The influence of manures on the chemical composition of the fruit is given in Table IV.

TABLE IV. — *Influence of manuring on chemical composition of strawberries.*

Soil	Manurial treatment	Yield of juice, per cent.	Sugar, in gms. per litre	Acidity, in gms. of H_2SO_4 per litre
A	Unmanured	54	63	6
	Dung	57	65	5.2
	Complete fertilizers and dung	56	73	5.9
	Slag and sulphate of potash	59	65	5.6
B	Unmanured	77	56	4.7
	Slag	68	67	5.0
C	Unmanured	54	63	6.0
	Potash	58	68	6.2
	Complete fertilizers and dung	56	56	5.5
	Dung	86	86	6.4
D	Slag and sulphate of potash	85.5	81	6.4
	Complete fertilizers	79.7	83	6.3
	Slag and nitrate	75.1	80	6.3
	Sulphate of potash and nitrate	81.3	80	6.3
	Compost, blood and cake residues	80.2	78	6.2

Influence of the soil on the fruit. — The following points for flavour were awarded by expert tasters to samples of fruit grown on different soils; the two trials were carried out separately (see Table V).

TABLE V.

Variety	Soil	Points	Remarks
1 st trial: Sharples	containing a fair amount of organic matter	80	typical.
	light sandy loam	109	best flavoured.
	low-lying sand	53	rather watery.
2 nd trial: Vicomtesse Héricart de Thury	rich wheat land in good condition	30	slightly acid.
	very light, non calcareous . . .	39	full flavoured, firm and dense.
	poor gravel	38	full flavoured.
	marly	26	flavour less good.
	gravelly sand with 9 per cent. carbonate and iron salts . .	39	full flavoured.

Analyses of the fruit from different soils are given in Table VI.

TABLE VI.

Soil	Yield of juice per cent.	Gms. of sugar per litre	Acidity in gms. of H_2SO_4 per litre
Slightly sandy	57	65	5.2
Low-lying sand	77	56	4.7
Sandy hillside, unmanured for 5 years . .	54	63	6.0
Garden	86	86	6.4

In another set of experiments the changes taking place during the maturation of the fruit were investigated and it was found that the acidity gradually diminished, while the amount of reducing sugars increased.

The chemical composition of 16 varieties is given and various schemes of manuring are discussed in the paper.

829 - **Fruit and Vine Growing in Central Asia.** — BARSACQ, JOS., in "Zapiski" *Simjeropólskaya Otdiela I. R. obshtchestva Sadovodstva*, No 142, 1914.

I. *Fruit growing.* — In Russian Turkestan there are 29 123 dessiatines (78 632 acres) under fruit, mostly in the form of small native orchards, though of late years there has been a distinct tendency towards the establishment of larger orchards, up to 250 acres or more in extent, by the Russian colonists.

Of all fruits, *apricots* are the most common and are not only consumed locally in enormous quantities but also exported to Siberia; a succession of varieties assures a constant supply from May to August. The next most common fruit is the *peach*; a flat-fruited variety known as "Cheftalé injir" is very popular, while the local varieties of nectarines are better than the European varieties. *Mulberries* are an important crop not only for the sake of their fruit but also as food for silkworms; the large fruited seedless varieties are eaten raw, or made into a kind of sirup which is used as a sugar substitute, or even dried and made into a kind of flour which is used as a substitute for bread in very out-of-the-way districts. *Walnut* trees are common in the forests of Ferghana, which, according to the most recent statistics, extend over 35 000 dessiatines (94 500 acres); walnuts are represented chiefly by a large fruited and by an early dwarf variety. Local varieties of *apples* and *pears* are few and worthless, but European varieties, more particularly those cultivated in Crimea, have been introduced by Russian colonists and excellent results have been obtained in the Vierny district with Aport or Grand Alexandre; in the neighbourhood of the large Turkestan cities, especially Tashkent where fruit growing is developing with rapid strides, satisfactory varieties have yet to be selected, for shallow rooted stocks such as paradise or quince yield poor

specimens of trees and probably suffer from the great summer heat (up to 122° F.) and the drought.

As regards management, in order to keep down weeds, which are a serious pest, lucerne is sown in the orchards with excellent results; pruning is only practised in a very primitive fashion; the orchards are irrigated four or five times during the course of the summer. Flowering takes place about one month before it does in the Crimea, and late spring frosts are liable to cause very extensive damage, especially to the hard fruits.

With regard to diseases, codling moth (*Carpocapsa pomonella*) is by far the most destructive and affects up to 80 and 100 per cent. of the apples; this insect, though native, has few natural enemies and an attempt was made to introduce *Oophthora semblidis* and other of its internal parasites, but without success. As the moth has three broods in a season, the late varieties of apples suffer most and 75 per cent. of their fruits are attacked as against 20 per cent. of the early varieties. Preventive and remedial measures employed successfully in other parts of the world, such as spraying, trapping, grease-banding, seem useless in Turkestan, but certain large growers have adopted the method of bagging their fruit and the practice seems to be spreading. *Tingis piri*, apple sucker (*Psylla*) and its allies, *Polypylla adpersa* var. *pulverea*, *Melolontha afflicata*, *Rhizotrogus solstitialis*, *Tropinota turanica*, *Oxythyrea cinctella*, *Cetonia marginicollis* also cause serious damage. Owing to the almost complete rainlessness of the summers fungoid pests are rare. Certain choice varieties of apples are frequently affected by so-called "Stippigkeit", which is thought to be of physiological origin though its cause is at present unknown; the disease is characterised by corky filaments under the epidermis which appear usually after picking, and it is spreading in a somewhat alarming manner.

Turkestan apples are inferior in quality to Crimean apples and the writer does not consider that the country will ever be capable of producing any but lower grade fruit; this produce will find an outlet in Siberia, which is being connected up direct with Turkestan by a railway. Early varieties of fruit will also be marketable in Russia, as they ripen about a month earlier than the crop in the European temperate regions.

II. *Vine growing*. — It is estimated that 25 000 dessiatines (67 500 acres) are at present under vines, of which 13 000 dessiatines (35 100 acres) are in the Samarkand district. Small vineyards are the rule. The writer gives a detailed account of cultural methods practised by the natives, including irrigation, which consists of five or six waterings during the summer.

As the Mahommedan law prohibits the use of wine, the varieties usually cultivated, amounting to about 40, are all table fruit with thick skins, few or no pips, and firm pulp; they grow in long loose bunches. About three quarters of the vineyards are planted with Kichmich, which is dried to produce currants. Masca is a very large kind with bunches averaging 3 lbs. in weight and sometimes reaching 10 lbs., while each grape may have a diameter of 1 ½ in.; the fresh fruit is in good demand not only locally but also in Moscow and Petrograd. Khoussainé is a common variety in the neighbourhood of large cities and is exported to the north

under the name of Ladies'-fingers; it keeps well and is a heavy cropper, producing 1 000 to 3 000 poods per dessiatine (13 000 to 40 000 lbs. per acre). Early varieties such as Ak-tchiliaku, which ripens at Tashkent about the middle of June, have also been cultivated of late years.

Russian colonists have tried certain European wine-making varieties, but though the vines appear to have become thoroughly acclimatised and yield good crops, the wine is of poor quality.

The exportation of fresh grapes to Russia is capable of great developments and is receiving encouragement from the Government in the shape of a supply of cold-storage trucks and an accelerated railway service; exports have increased steadily since the opening of the Tashkent railway.

The dried raisin industry, too, is worthy of encouragement, for the climatic conditions are eminently suitable for the drying process and the produce could be vastly improved by the introduction of more up-to-date methods. About 1 250 000 poods (45 million lbs.) of dried raisins and currants are sent annually from Turkestan to Russia and another two million poods, consumed by the latter country, are furnished by Persia and Greece when they might easily be produced in Turkestan.

Wine making, on the other hand, suffers on account of the great summer heat and excessive sweetness of the grapes and has made little progress; white wines are coarse and have a bitter after taste, especially when made with local table varieties; the writer is of opinion that ordinary table wines will never be greatly improved unless the processes of vinification are considerably modified, but there are great possibilities as regards the production of sweet wines with a high alcohol content. The manufacture of brandy has been attempted by a few firms, but without much success, as only a coarse high coloured spirit has been obtained.

Phylloxera is unknown in Turkestan, while fungoid pests are rare, being limited to *oidium* and *Cercospora*. The most serious enemies are certain birds which destroy large quantities of grapes in some places; dogs too do considerable damage, as they are rarely fed by their native owners and grapes represent a welcome addition to their diet.

LIVE STOCK AND BREEDING.

830 - Experiments on the Control of Warble Flies in Germany (1). — SCHÖTTLER and GLÄSER, in *Mitteilungen des Ausschusses zur Bekämpfung der Daseipha*, e, No. 6, pp. 1-31. Berlin, 1914.

HYGIENE

In 1913 the Warble Control Committee undertook the treatment of the cattle in the district of Neuhaus on the Oste; out of a total of 3892 head, 2933, or 75.4 per cent., were freed from warbles; the number of larvae removed was 47 625, that is an average of 16.2 warbles per head. The work was done in the second half of April shortly before the cattle were turned out to graze; the average time for dealing with each animal was a quarter

of an hour. The larvae were either squeezed out by hand or extracted by means of tweezers. Most of the cattle kept fairly quiet during the operation, and in only 21 cases did a slight nettlerash follow. The total cost amounted to 423.70 M. (£20 15 s 5 d), or 0.89 Pfg. (0.11 d) per larva, and for each of the 3892 head of cattle existing in the district a little over 1 d. This is about the price paid formerly in Oldenburg for removing warbles. The cost, however, varied from one locality to another and with the kind of cattle. Heifers and steers were the most affected with warbles, while cows had not so many, though they were certainly not free from them; bulls had the lowest percentage of warbles. Considering the depreciation of each hide due to warbles to be 3.89 M. (3 s 9 $\frac{3}{4}$ d), the loss of the farmers in the district under consideration was about £ 560. If the reduction in the amount of flesh laid on and the check in the growth of the young cattle be also taken into account, the loss would probably be twice as much.

In a second part of their paper the writers report upon last year's campaign against warble flies in the district of the Wesermarsch Herdbook Association in the Grand-duchy of Oldenburg, where for several years it has been compulsory to free cattle from warbles. In order to give an idea of the success of the control of warbles the Chamber of Agriculture, by means of the communal authorities, distributed among the owners of cattle upwards of 13 700 question-sheets; 3000 replies containing sufficient data were arranged statistically. The extraction of warbles in Oldenburg was carried out in most of the cases by the owners themselves and only exceptionally by professionals, who in general were more successful than the former. The number of cattle to which the replies referred was 42 593, that is 40.60 per cent. of the whole stock of cattle in the district; of these, 27 870 head or 64.43 per cent. bore warbles. The percentages were: cows 66.35, heifers 87.69, steers and bulls 85.81, and calves 8.58. In the herds examined there were 312 495 warbles, which would give about 770 000 for all the cattle of the district, or 7 or 8 per head of the whole and 11 or 12 per animal infected. The lowest number was found on the calves, which had barely one each, while the cows had 4 or 5 and the steers 12 or 13. The total number of larvae killed was 204 184; the greatest freedom from warbles was obtained where the operation was repeated in May. On the "Geest" (high-lying land) pastures the cattle suffered more from warbles than on the marsh pastures on account of the greater dryness of the former. The same had been observed also at Neuhaus on the Oste.

Lastly the writers report an experiment made by them to demonstrate that the warble larvae caused the cattle to lay on less flesh. Ten steers were kept under exactly the same conditions, five being freed from warbles and the others not. The result was that the former gained an average of 37.4 lbs. per head more than the others. Thus it appears that the loss in flesh caused by warbles is still greater than the loss caused by damage to the hides.

831 - Effect of Long Storage of Meadow and Clover Hay on its Composition and Digestibility. — HONCAMP, MÜLLNER and STAU, in *Die landwirtschaftlichen Versuchsstationen*, Vol. 84, Part 5-6, pp. 447-481. Berlin, June 16, 1914.

FEEDS
AND FEEDING

I. *Meadow hay.* — The hay used in this experiment had been stored for six weeks in a hay loft; it was then chaffed, uniformly mixed and wrapped in paper to prevent losses of any portion of it. After this it was kept for three years in a large airy room not heated in the winter. The samples were analysed: 1) at the beginning of the experiment; 2) after a year and three-quarters; 3) after three years. The results of the three analyses did not differ to any extent from each other.

In the digestibility trials, the hay was fed to two sheep at the rate of 1.54 lbs. per head per day at five different periods. The average coefficients of digestibility obtained are shown in Table I (averages of the two sheep).

TABLE I.

Period	Dry matter %	Organic matter %	Crude protein %	N-free extract %	Crude fat %	Crude fibre %
I. August 1909	58.9	60.8	68.0	59.6	48.2	59.8
II. May-June 1910 . . .	60.4	62.5	68.3	62.6	48.1	61.6
III. May 1911	59.6	61.3	69.6	60.5	46.0	59.7
IV. February 1912 . . .	58.0	59.8	67.4	58.1	51.5	59.5
V. Aug.-Sept. 1912 . .	59.8	61.5	68.8	60.5	51.1	61—
Increase of digestibility in 5th period as compared with 1st	0.9	0.7	0.8	0.9	2.9	1.2

The digestibility of meadow hay has thus remained very constant during the three years and has in nowise suffered from the long storage; the variations of digestibility observed fall within the limits of experimental error. The writers conclude that by proper storage with suitable ventilation meadow hay does not suffer any loss either in its nutritive contents or in its digestibility, and that the different results obtained by other observers are due to losses caused by mechanical action, such as the dropping of the leaves rich in nitrogen and consequent proportional increase of the more fibrous stalks, or by lack of proper precautions in sampling.

II. *Clover hay.* — The clover hay used consisted of 60 per cent. clover and 40 per cent. ryegrass; it was chaffed and well mixed, part being wrapped in paper and part placed in a dry loft. It was kept for two years, and during this time did not show any change in its content of nutritive matter. For the experiments on its digestibility it was fed to two sheep in six different periods. The average coefficients of digestibility for the two sheep are given in Table II.

TABLE II.

Period	Organic matter %	Crude protein %	N-free extract %	Crude fat (Ether extract) %	Crude fibre %
I. July-Aug. 1911	62.9	65.0	66.0	58.9	56.5
II. Dec.-Jan. 1911-12	61.9	60.8	67.2	55.3	54.0
III. Sept. 1912	62.7	62.4	67.4	56.0	55.5
IV. Sept.-Oct. 1912	60.2	60.2	65.3	53.4	52.4
V. Sept. 1913	61.8	60.7	66.9	61.4	54.0
VI. Sept.-Oct. 1913	60.0	60.7	63.9	56.4	53.7
Decrease of digestibility in the 6th period as compared with the first	— 2.9	— 4.3	— 2.1	— 2.5	— 2.8

During the periods 1, 2, 3 and 5 the hay fed was taken from the paper wrappers and during periods 4 and 6 from the loft.

The differences in the digestibility during the various periods are so small as to lie within the limits of experimental error. The writers therefore conclude that clover hay does not suffer any loss either in its nutritive contents or in its digestibility.

With both meadow hay and clover hay the valuation according to botanical analysis agreed with that based on the digestible protein and on the starch value; on the contrary valuation according to crude protein and crude fibre content did not agree with valuation according to botanical analysis.

The classification of fodder is therefore to be based exclusively on its content in digestible protein and starch value.

832 — **The Value of Different Kinds of Straw as Fodder.** — HONCAMP, RIES and MÜLLNER, in *Die landwirtschaftlichen Versuchsanstalten*, Vol. 84, Part 5-6, pp. 301-398. Berlin, June 16, 1914.

This is a critical study on the present views, mostly based upon old experiments of Henneberg, Wolf and others, on the food value of different kinds of straw. The investigations dealt with the straw of barley, oats, wheat, rye, spelt, peas, lupins, rape and colza. Each kind of straw was examined as to its content in organic matter (according to the usual methods) and inorganic matter and crude fibre (according to König, Weender, Cross and Bevan); it was then fed to two sheep in order to ascertain its digestibility.

As the weather is said to influence the chemical composition of straw and also to a certain extent its digestibility, the straw of the very dry year 1911 was compared with that of the wet year 1912, as far as possible. In most cases the different straws were taken from the same farms. The

wheat straw was mixed with hay and 0.66 lb. of it was given to each sheep per diem. The straw of Cruciferous and of Leguminous crops was fed at the rate of 1 lb. per day and mixed with beet-slices, soy-meal and hay.

The results are summarised by the writer as follows :

1. The general opinion that spring grain straw is poorer in crude fibre than the corresponding winter grain straw is in many cases erroneous.

2. The weather conditions have in general a relatively small influence on the percentage of organic and inorganic matter in the different straws, or at least this influence is not so marked as in fodders richer in protein.

3. König's crude fibre method gives mainly a pentosan free crude fibre, which is not the case with Weender's method. To this is probably due, in many cases, the lower yield of crude fibre by the former method. König's method for the determination of pure cellulose is not correct; at present Cross and Bevan's method is more trustworthy.

4. The straws of spring and winter grain can be considered of equal value as to their digestibility. The straw of Cruciferae (rape and colza) is inferior in value to cereal straw, while the straws of Cruciferae and of Leguminosae are about equal.

5. The value of a fodder is correctly expressed only by its starch value. The classification of fodders according to protein and crude fibre content leads in general to erroneous conclusions.

833 - **The Contribution of Bacteria to the Feces after Feeding Diets Free from Indigestible Components.** — OSBORNE, T. B., and MENDEL, L. B. (Connecticut Agricultural Experiment Station) in *The Journal of Biological Chemistry*, Vol XVIII, No. 2, pp. 177-182. Baltimore, Md., July 1914.

The feces of 17 rats fed on various diets entirely free from indigestible components were investigated with a view to determining what proportion of the excrement was made up of dead bacterial bodies. The special diets consisted of protein, starch, protein-free milk (1), and lard, so that it was possible to avoid the great difficulty always encountered in previous experiments of separating the bacterial cells from fragments of more resistant undigested food. The feces were dried and ground; the powder thus obtained was then successively extracted with ether, alcohol (absolute and 80 per cent), 0.2 per cent. hydrochloric acid, and absolute alcohol containing 0.2 per cent. hydrochloric acid. The final residue varied from 22 to 41 per cent. of the dried feces and its nitrogen content calculated on an ash-free basis was fairly constant, amounting to from 10.7 to 12.2 per cent., which corresponds closely to numerous recorded analyses of bacterial cellular substance. Microscopical examination also suggested that the residue consisted of an almost uncontaminated mass of bacterial bodies.

(1) See No. 1171, B. Oct. 1913; No. 142, B. Feb. 1914.

(Ed.).

834 - **The Breeds of Horses in Norway.** — *Communication from CHR. WRIEDT, presented by the Delegate of Norway.*

Under the action of the special conditions of Eastern Norway a special breed of horses, known under the name of Gudbrandsdal (a valley in Central Norway), has been developed. These horses are raised by small farmers.

As for its origin, it is most probably the most northern branch of the western horse. Its appearance and anatomical structure resemble greatly those of the Danish Jutland and of the old Hessian horses. This agrees with the hypotheses as to the emigration of the human races. To the native breed of the Gudbrandsdal foreign blood was introduced during the 17th and 18th centuries and during the first half of the 19th. During the first two centuries it was especially Danish blood, chiefly due to stallions from the old stud of Friedriksborg. Later, in the first half of the 19th century, only a relatively small amount of foreign blood was introduced and that of very different origins. The importation of a Thoroughbred English stallion *Odin* is of special interest: its third generation included *Balder*, whose blood is at present diffused in all the Gudbrandsdal breed.

These horses are mostly bay or black; about 4 per cent are chestnut and 1 per cent cream, while white is quite exceptional. Specially marked animals are relatively rare. The stature of the stallions taken as an average of 90 four-year-old horses born between 1900 and 1904 was 15 hands 1 inch. The mares are generally about 1 inch less.

The head is usually of average length, with a straight and broad forehead and well set ears. The neck is somewhat heavy for the size of the horse, and the head not very well set on. The chest, of average depth, has a good breadth; the average girth of the above-mentioned 90 stallions was 74.02 inches. The withers are of a good shape. The back is inclined to be too long, but there are many specimens with a very handsome back. The ribs are well arched; the rump is somewhat sloping and of average length and breadth and on the same level as the withers. The tail is set on high. The thighs are well proportioned as to length and are muscular. Altogether the muscular system is well formed. The legs are of average length. The hocks are large, well shaped and clean forming a proper angle. Occasionally turned in hocks occur. The cannon bones are of average length and clean, the pasterns short or medium and duly sloped, sometimes upright in stallions. The shoulder has a good position. The knee is well formed and strong; flat and knock knees never occur. The cannon bones of the fore limb are also clean; measured in the narrowest part, they averaged, in the 90 horses examined, 8.37 inches. The fore pasterns are of average length and duly sloped; occasionally however defective positions are met with. The hoofs are of average size and of excellent quality; formerly they were often thin and flat owing to defective breeding, but now these defects have completely disappeared.

The action of these horses is regular, their trot long, but their gallop

not very elegant. It is a very suitable horse for the peasants, being hardy and thrifty as to food.

They are usually fed on hay, oats and rye bran ; in some places forest leaves are added but hay is always the principal food. Foals usually get about 11 lbs. a day during the first winter and 13 to 20 the next three winters. The daily ration of oats is from 2 to 3 ½ lbs. during the first winter ; in the succeeding winters very little oats are fed, 2 to 3 lbs. of rye bran being given instead.

Throughout the whole summer the young animals are turned out to graze and the brood mares are collected in droves of about 40, with one stallion, on the mountain pastures. These pastures belong to the State or to private owners. The latter let them to associations or possess a stallion of their own. In 1907 the national stallions gave 85 to 95 per cent. of fertile matings on the pastures and only 68 to 77 per cent. in the stables.

The State assistance consists of grants to associations for the purchase of stallions. These grants amount in some cases to £ 100 or £ 150. The State endeavours also to favour horse breeding by yearly shows, the most important of which is held at Lillehammer at the end of April or beginning of May; often as many as a hundred or a hundred and twenty stallions are collected here. The greater number are sold, fetching from £ 150 to £ 600. Most of them remain in Norway, but a good number go to Sweden and Russia and of late years some have been sent to Austria. Besides the Lillehammer show there are smaller national shows which are generally held in the autumn and in which mares are more in evidence. The mares which have had prizes or have been approved, obtain for five years the right to pasture free with the national stallions. The price of a draught horse varies between £ 35 and £ 44.

The Studbook is kept by the State. The first volume appeared in 1902, the fifth this year. Only the stallions that have been awarded prizes at the shows are entered. Exception may be made for a stallion getting good stock. Mares must be pure bred and must have already borne foals to a Gubrandsdal stallion. Some conditions concerning their outward conformation have also been added.

Among the measures for encouraging horse breeding due to private initiative, the numerous trotting societies which organize matches during the winter must be noticed. Most of them are united in a large association " Det norske Traverselskab " (The Norwegian Trotting Association). At most races only pure bred Norwegian horses are allowed to compete.

The native breed of Western Norway is called the Fjord breed. Its origin is not completely known ; possibly it is a branch of the Celtic pony. The Fjord is a wiry horse, standing 14 to 15 hands 1 in. high. Its coat is almost always whitish, but of different shades ; from time to time also bays are met with. The head is small with a broad and straight forehead and small and very mobile ears. The neck is strong and the head well set on. The chest is deep and of average breadth. The withers are round, the back of average length, and the ribs well arched. The rump is slop-

ing and often not quite muscular enough. The tail is high set and free. The thighs are muscular and of satisfactory length; the hocks are always clean but their breadth is not always sufficient; they are often much turned in and the angle they form is not always ample enough. The cannon bones are of average length, and clean; the pasterns are short and set at a true angle. The shoulder is somewhat short and vertical; the arm and forearm are of medium length, the latter being often poor in muscle. The knee is well formed; the fore cannon bones are clean and well marked; the fore pasterns are short and generally well formed, though sometimes owing to defective breeding knock-kneed animals are met with. The hoofs are small and of excellent quality. The step both walking and trotting is rather short, but the rapid action allows a great speed to be attained. These horses are very hardy and exceptionally enduring, and frequently travel 50 to 70 miles in a day.

SHEEP

835 - **Formation of a German Sheep-breeders' Union.** — *Zeitschrift für Schafzucht*, Part 7, pp. 145-150. Hanover, July 1914.

On the occasion of the German Agricultural Society's Show at Hanover this year a Union of German sheep-breeders was founded (*Deutscher Schäfereiverband*) with the object of uniting all the existing associations of sheep-breeders and individual breeders in an association for furthering sheep breeding in Germany.

GOATS

836 - **The Angora Goat.** — HELLER, L. L., in *U. S. Department of Agriculture, Farmer's Bulletin*, No. 573, pp. 1-16. Washington, April 27, 1914.

The value of the 1909 clip of mohair in the United States was \$901 597, that is nearly four times as much as in 1899. The number of fleeces of mohair rose from 454 932 in 1899 to 1 682 912 in 1909. Of this latter number 1077 463 came from Texas, 155 980 from New Mexico and 141 588 from Oregon; Arizona and California each contributed upwards of 100 000 and Missouri was the only other State with over 20 000. The average weight per fleece was 3.7 lbs. in Oregon and 1.85 lb. in Texas. In the latter State many Angora goats are shorn twice a year, for which reason the yield of mohair per head is undoubtedly above the census figure for the average weight per fleece in the State. Assuming that one third of the Texan Angoras are shorn twice it would appear that in the United States the total number of Angoras of shearing age was about one million.

During the last few years the breeding of these goats has increased in importance more than that of any other animal and it is now carried on in almost every one of the States. Conditions are especially favourable to this branch of animal husbandry in the North-West, in which brush is so abundant, and where the Angora goat contributes greatly to the control of forest fires by clearing brush lands. American Angoras have hitherto been exported mostly from California to South Africa, Canada, Alaska and recently also to Brazil and the Argentine Republic. The first Angoras introduced into the Union were mostly crossed with common goats in order to obtain a larger and hardier animal. The first and second crosses showed but little mohair and much kemp, and five or six crosses with pure

Angoras were necessary before a really superior animal was obtained. After the fifth cross the product could be considered as pure bred Angoras. The writer does not consider it advisable to cross with common goats in order to obtain Angora flocks. He considers it better to import good original animals and to keep them pure from other strains.

The Angora goats of the United States are generally pure white and horned. Their ears are either partially erect or drooping. Their bodies denote a good constitution; they are symmetrically built, and with the exception of the inside of the upper part of the legs they are well coated with fleece. The demand is for fine quality, closely curled, very glossy fleeces and as nearly as possible free from kemp.

The price of mohair has of late years much increased in the Union owing to the many usages to which it is put (manufacture of plush, overcoats, wigs, etc.). The weight of fleece for American Angoras ranges between 2 and 12 lbs. The fleece of a one-year-old goat weighs 2 ½ lbs. Where the fleece is allowed to grow for 12 months the average length of staple is about 10 inches. The total weight of the fleeces produced in the United States in 1913 amounted to nearly 5000 000 lbs. The best of it comes from the North-Western States. The average cash production of a goat is, according to the North-West Angora Goat Association, \$ 1.75 and with many as much as \$ 2.25 per annum. Besides this considerable home production, the United States import, in round numbers, about 2 000 000 lbs. of mohair, which is on the average superior in quality to the American produce.

The loss of weight in washing of the home hair is about 12 to 15 per cent., rather greater than that of the imported article. The skins of Angora with the hair attached are sometimes tanned in the United States and are much used for rugs, carriage robes, etc. The flesh finds a ready market, especially in Kansas City. The average weight of the goats slaughtered there is about 68 lbs.

Shearing takes place from February to March and the second clip in September or October in the South-West, and from March to April in the rest of the country.

The most important Angora breeding associations are the "American Goat Breeders' Association", the "National Mohair Growers' Association" and the "North-West Angora Goat Association".

837 - **Chicken Rearing.** (1) — *The Journal of the Board of Agriculture*, Vol. XX, No. 12, pp. 1049-1057. London, March 1914.

POULTRY

The demonstration by Mr. F. G. Paynter of his system of producing table poultry, which was commenced in December 1912 at Haslington Hall, near Crewe, under the auspices of the Board of Agriculture and Fisheries in conjunction with the Cheshire County Council, came to an end in December last. An area of 4 acres in the middle of a newly formed small holdings colony was devoted to the demonstration, and from that point of view was particularly suitable for the purpose.

(1) See also No. 160, B. Feb. 1913.

(Ed.).

During the whole time the demonstration lasted it was thrown open to the public. The Cheshire County Council appointed a temporary demonstrator whose chief duty it was to show people round and explain the system to them; the result of these and of other means to attract those for whose benefit the demonstration was designed, was that a large number of people visited Haslington Hall while the work was in progress.

Incubation was commenced in the beginning of December 1912 and terminated by the middle of the following July. Three incubators holding 340 eggs, and one holding 390 eggs were used. All the eggs were bought from various sources. The result of the incubation was as follows:

Number of eggs bought	9 897
" " broken	294
" " infertile	1 690
" " not hatched	3 885
" of chicks obtained	4 028
Percentage hatched on total number of eggs incubated	41
" of chickens hatched after allowing for broken and infertile eggs	51
Average cost of eggs per chicken hatched	4 $\frac{1}{2}$ d

The proportion of chickens hatched to eggs purchased was never more than 54 per cent. This relatively small proportion was partly due to shaking in transit and it is probable that better results would have been obtained if reliable eggs could have been purchased locally.

From the incubators the chickens were removed to the brooders, and when they were seven weeks old they were removed to larger wire runs (100 x 10 yards) and housed in so-called "Sussex arks," where they stayed until about 16 weeks old, when they were ready for sale. The plan adopted by Mr. Paynter for disposing of them was to contract beforehand for the sale of the whole of his output to a poulterer near London, at fixed prices varying from 3s 9d in April to 2s 6d in September.

The number, values and weights of the chickens sold were as follows:

Number of birds sold	3 471
Weight	13 968 lbs.
Average weight of chickens when sold	4.024 lbs.
Value of birds sold	£496 8s 1d
Average price per pound	8 $\frac{1}{2}$ d

The following is a summary of the food consumed and of its cost:

	£	s	d
3 437 lb. Chick feed	24	10	1
7 071 " Biscuit meal	40	5	8
711 " Oatmeal	5	3	1
389 " Rice	3	2	3
1 899 " Bran	6	18	9
2 862 " Meat and fish meal	24	9	3
4 475 " Barley meal	19	18	4
21 210 " Sharps	77	6	7
18 985 " Wheat with 10 per cent. of maize	68	3	5
	£ 269	17	5
Grit	5	10	0
Total food bill	£ 275	7	5

The profit and loss account shows a net profit of £55 1s 2d. This is relatively small, but it must be borne in mind that the work was seriously interfered with by the reception of so large a number of visitors, and that the outlay was valued somewhat high. In practice a small holder would save on several items, such as part of the work, and his profits would be higher.

During the current year Mr. Paynter is conducting a similar demonstration in Cambridgeshire.

838 - Experiments on Egg Laying in Different Breeds of Poultry. — (Eighty-fourth Report of the Royal Veterinary and Agricultural College Laboratory for Agricultural Experiments at Copenhagen). Communicated to the International Institute of Agriculture by the Correspondent for Denmark.

The object of these experiments was: 1) to determine the difference in the yield of eggs of various breeds of poultry; 2) to throw light on several conditions of fertility of the eggs and on the colour of the shells.

1. Experiments were carried on for three years on the egg laying of the following breeds: White Leghorn, Brown Leghorn, Barred Plymouth Rock, White Wyandotte, Black Minorca and Houdan. The Leghorns took first place for both number and total weight of the eggs. While the average number of eggs laid by the Leghorns during the three years was about 100, the Plymouth Rocks laid about 70, the White Wyandottes about 60, the Black Minorcas about 90 and the Houdans about 80. The figures for the last three breeds, however, are only approximative as in several of the pens disease was rife.

In comparative trials of Brown Leghorns, Nassaus and Orpingtons, the latter gave the highest yields, followed by the Leghorns, the Nassaus coming last. Considering only one-year-old hens the Nassaus and especially the Orpingtons laid more eggs than the Leghorns, but if the two to three-year-old hens be included in the amount the result is somewhat more favourable to the Leghorns. The good result with Orpingtons is to be attributed not only to relatively better laying, but especially to a more uniform distribution over the individual months in the year.

2. As to the most profitable age for egg laying it has not been possible to determine any sure rule. Most hens lay the greatest number of eggs during the first or second year, but there were some that produced more in the third year. In general it may be considered that the greatest number of eggs is obtained during the first year.

3. As for summer and winter laying there is no large difference between Plymouth Rocks and Leghorns, the former laying a slightly greater percentage of their eggs during the winter months than the latter. It has also been observed that the older hens lay a smaller percentage of their eggs during the winter months than the younger ones.

4. The weight of individual eggs was greater for Minorcas and Leghorns than for White Wyandottes and Houdans. It seems as if the weight of the eggs increased with the age of the hen.

5. Repeated weighing has shown that the weight of the birds increases with age, but only up to the end of the second year, when they are

fully grown. Within each year the weight of the body seems to follow certain laws, according to which it grows from autumn to spring and sinks again during spring and summer. This is especially noticeable in good layers, the body weight of which decreases to a greater extent than that of the bad layers during the spring months when egg laying is more active.

6. From the observations made, it appears that broodiness, which is more frequent among Plymouth Rocks than among Leghorns, is most pronounced in the best layers.

7. The above experiments have further shown that 16 days after mating the hens still lay fertile eggs. When mating is repeated after a period of more than 16 days, the first fertile egg is generally laid three days, and sometimes four days later.

It has not been possible to influence the colour of the egg shell by pairing a cock of a breed which has yellow or brown eggs with a hen of another breed that lays white eggs, or viceversa. The breed of the hen is alone responsible for the colour of the egg shell.

The number of eggs laid, as given in paragraph 1, will be thought somewhat low and there are doubtless many flocks of poultry in Denmark that lay more eggs. One of the reasons of the relatively low number of eggs obtained during these experiments is that for the sake of other tests, the poor layers, which a private breeder would soon get rid of, had also to be kept. Thus, for instance while one Plymouth Rock laid in the three years 200, 177 and 182 eggs, another one laid during the same time only 2.5 and 4 eggs respectively.

SILKWORMS

839 - Contribution to the Study of Sericulture in Indo-China. — BUI-QUANG-CHIEU, in *Bulletin économique de l'Indo-Chine*, Year 16, Nos. 101 and 102, pp. 165-178 and 375-401. Hsin I-H Iyhong, March, April, May, June 1913.

Silkworm breeding was introduced into Annam from China about the tenth century. It was encouraged by the Annamese emperors, especially Gia-Long and Minh-Mang, and soon became a flourishing industry in the peninsula, continuing in this condition up to 1851, after which date its progress ceased. The French administration, notwithstanding many efforts, has not yet succeeded in giving sericulture in Indo-China the development which the good natural conditions of the country would allow; on the contrary the industry has even declined. This state of things is due to deep-seated economic and social causes:

1. The intense literary culture, which induces the educated Annamese to take up administrative careers (as mandarins) and to neglect agriculture and industry.

2. The improvements in the European cotton industry, which provides Indo-China with cheap and good cotton goods that have in many cases taken the place of the old silk tissues.

3. The natives were formerly taxed, by the mandarin administration, arbitrarily and according to their apparent wealth; consequently they did not dare to use the fine Chinese silks which would have marked them out to the rapacity of the mandarins. Under the French administration they have abandoned the Indo-Chinese silks in favour of the Chinese

fabrics and of late years they have made much use of Lyons and Japanese silks, notwithstanding their higher prices.

4. The neglect of the cultivation of mulberries for that of rice, the latter being easier to sell than cocoons ; besides which there is no doubt that the diseases to which silkworms are liable have discouraged many native breeders.

At the time of the French conquest, according to Dr. TURC, great centres of production existed in the huyen of Kien-duong (now Cai-fây, Cai-bé and Rach-gâm) in the province of Dinh-tuong (Mytho) ; the districts of Sadee and Bentré, which sent their produce to the great market of Vinh-long ; in the east of Cochiu-China the districts of Baria, Long-thanh and Thudau-môt ; at present next to nothing remains of the great plantations. In 1870 French spinning mills were started at Cholon, but they had to be abandoned on account of the fall in prices on the Lyons market. In 1883 the Government nominated a mission for the reorganization of sericulture and founded a silkworm breeding establishment at Cholon, in which an attempt was made to improve the native worms by crossing with foreign breeds. The results were bad, and the same was the case with all attempts at crossing with Chinese or Japanese worms. M. VIEIL believes that these failures are due to the fact that the native worms, being more slender, can eliminate water vapour better than the French, Chinese, or Japanese worms, which are fatter and consequently present a smaller evaporating skin surface in comparison to their weight ; he does not think that there has been, as has often been asserted, any degeneration of the Indo-Chinese worms. He believes also that breeders have launched thoughtlessly into the system of crossing, which, if it had been preceded by study and systematic experiments on the best breeds more akin to the native breeds, might have yielded far better results.

In 1905 a silk specialist was entrusted by the Governor-General with a mission which resulted in the formation of a French company ; this entered into an agreement with Indo-China for the selection and free distribution of silkworm eggs to the natives by means of subscription. The old spinning mills of Nam-dinh were resumed and the breeding farm of Phu-lang-thuong, which was managed by M. VIEIL, was attached to it. The latter came to the conclusion, from the experiments he made, that it was better to keep to the improvement of the Annamese breeds and to teach the natives how to rear the worms. At the same time reeling basins of European pattern were simplified for the natives. These basins, the price of which is not above 12 shillings, were given free of charge to the Annamese ; a Lyonnese employee of the Agricultural Service, a silk specialist, was instructed to teach them the way of using them.

All these efforts are beginning to bear fruit and already the quality of the silk exported to the mother country is improving. Indo-China has not followed the rapid progress of Japan ; even Corea and Siam have developed their sericulture. Indo-China, which has a population well adapted to this kind of industry and which might make use of the scientific results

acquired by the mother country, will also see a great increase in its silk production.

Geographical distribution of sericulture in Indo-China.

The whole of Indo-China raises silk, but the delta districts take the lead.

Tonking. — The provinces in which silkworms are reared on a large scale are the following, arranged according to their importance: Nam-dinh, Thai-binh, Bac-ninh, Phu-lien, Phu-lang-thuong, Phu-ly, Hung-yen, Hanoi and Son-tay. Mulberries are grown in the alluvial lands, on the banks of rivers (Red river, Song-thai-binh, Song-thuong, etc.). Reeling and weaving are practised especially at Nam-dinh and Thai-binh. There are at Phu-lien flourishing plantations and important native weaving factories (Do-son, Kien-an).

Annam. — Sericulture is practised in all the provinces, but in the south (Khánh-hoá, Phú-yên) and in the north (Thánh-hoa, Quang-binh) it has rather declined; it has markedly progressed in the centre in Binh-dinh and Quang-nam. At Phu-phong, in the province of Binh-dinh, there is a great industrial spinning and weaving centre. Silk raising has declined in the province of Thua-thien, the only centres being the huyen of Phu-vang and the district of Thien-mô, which are not very important.

Cochin-China. — The silk industry is more widely spread but in a more backward state than in Tonking. There are no European factories and the attempt made twenty years ago by commander COLBERT DE TURGIS at Tan-chau to establish a station for killing the pupae in the cocoons failed. There are, however, about 3700 acres of mulberry plantations and all the silk industry is in the hands of small native growers and is at the same level as it was two thousand years ago. There are also some important centres of mulberry growing and silkworm rearing in the province of Chau-dôc, especially in the mountainous district about Thai-son, Tu-tê, and Triton, where the inhabitants are chiefly Cambodians. The island of Cù-lao-ba and the Malay canton of Châu-giang form an important spinning and weaving centre. In the province of Long-xuyên, the mulberry belt extends from Cù-lao-giêng to the Ongchuong canal, including the village of Long-diên and others, as well as some islands round Cù-lao-giêng. The village of Cho-tu-chên-sai is the most important centre of this district (and perhaps of the whole of Cochin-China), exporting its silks (generally dyed black) especially into the provinces of Càn-tho, Rach-giá and Bac-lieu. The province of Sadee, formerly renowned for its worked silks called "hang-không-tren," has to day only La-vung as centre, and this is of no great importance. The course of the Mékong has then to be followed as far as Bentré (Batri and Mocay) before the mulberry is again met with. A kind of taffeta called "lue", which formerly had a certain reputation, is woven there. In the provinces of Bac-lieu, Soc-trang and Tra-vinh all the silk industry is in the hands of Cambodians; the Cambodian centres of Tra-kha, Tra-cu (Tra-vinh), Vinh-châu, Vinh-phuoc (Bac-lieu), Lai-tâm, Var-

thap, Phuoc-lai and Yên-tập (Soc-trang) cultivate mulberries, breed worms and weave the silk.

Cambodia.—All the banks of the Mékong between Tân-châu and Pnom-penh are planted with mulberries in the parts that are inundated every year. On the borders of Cochin-China is the silk centre of Banam, in the province of Prey-veng, which has raised worms from the eggs of the Station of Takeo (Pnom-penh).

The Upper Mékong seems to have a certain future before it from the sericultural point of view; silk raising is much scattered; the resources of Laos are imperfectly known, and unfortunately the attempts made in Tonking and Cochin-China have not been extended to this locality.

The breeds of silkworms in Indo-China.

They are polyvoltine, generally with yellow cocoons, exceptionally dirty white. It requires 18 to 20 lbs. of fresh cocoons to produce 1 lb. of raw silk reeled after the European fashion. The complete evolution of the worms lasts from 42 to 46 days: 10 for hatching the eggs, 20 to 30 according to the weather for the growth of the worms and from 10 to 11 for spinning and pupation.

Annamese breeders distinguish the following four breeds: Bâu-bi, Bau-diêu, Ken-se and Tầm-soc; their characters however are badly defined. The writer gives some of them. The Tonking breeds are generally of larger size.

Silkworm rearing.

The writer studies the native systems in order to draw the attention of European breeders who would improve their defective details.

The breeders themselves attend to the egg-laying; the unit adopted is the "cup" (the quantity of eggs laid by 4 or 5 fertilized female moths put together under a cup). No selection is practised. Native breeders generally undertake the raising of a number of worms too great for their available space. Their yields are not remarkable, 22 to 28 lbs. of cocoons for 100 layings, and often less.

Incubation does not require any special care. Hibernation is not practised. The eggs have only to be protected against red ants. Annamese breeders remove the newly hatched worms only in the afternoon or the day after the first eggs are hatched, which has the effect of obliging those that are hatched first to fast until the late ones come out. The young worms are swept off with a feather, many being injured in the process.

Moulting lasts 24 hours; the longest of the stages, the last, is of eight days. The food of the worms is frequently very imperfectly chopped and may contain fragments of wood which wound many worms. The worms are set to spin their cocoons on hurdles which yield up to 11 lbs. of cocoons each.

The breeder does not usually spin the silk, but sells his cocoons to a spinner at current prices minus a rebate of 1d per 11 lbs. in favour of the

spinner. When the worms have thriven well and produced cocoons suitable for reproduction they fetch as much as twice the price paid for cocoons for spinning.

The defects of native breeders are the following. They hatch out a quantity of eggs much superior to their means (this applies specially to the Cochin-Chinese); being short of hands they hurry roughly through the various operations, causing injury to the worms; this injury is then attributed to occult powers, which the breeders seek to appease by superstitious practices instead of improving their methods of breeding. The most elementary rules of hygiene are unknown; the diseased worms are thrown about anywhere and become new sources of infection.

Diseases and enemies of silkworms in Indo-China. — The most widespread diseases are: "pébrine," "grasserie," "flacherie" and "muscardine"; a fly called "con-lang" also causes a good deal of damage.

Pébrine, called in Tonking "tam-gai", causes much less havoc in Indo-China than in France. It is beginning to decrease owing to the free distribution of selected eggs; the sale of unselected eggs should be forbidden and more lectures for the natives should be given.

Flacherie, called "tam-lung" in Tonking and "tam-di-duor" in Cochin-China, appears especially in the last stages.

Some worms cannot digest their food and die without exhaling the characteristic odour of flacherie; under the microscope they show bacilli in moniliform strings.

Another disease, called "tam-kuong" in Tonking, causes the worm to stretch out, and the third to the sixth ring to blacken; the last rings become transparent; the worm then dies and exhales a fetid odour.

Grasserie appears under various aspects, according to which it bears various names; it is especially frequent in moist and stormy weather. It causes much havoc and often destroys whole batches of worms.

Muscardine is rather rare in Indo-China and is not much dreaded by native breeders.

The "red disease" is not very serious; it attacks the moths, which die after having laid a limited number of eggs.

The fly "con-lang" deposits its eggs on the worms and secretes at the same time a corrosive liquid which attacks the skin and makes an opening in it, through which the egg penetrates into the worm where the larva feeds on the tissues of its host, reducing them to pulp; one worm can carry as many as 6 or 7 larvae. When the latter are fully developed they issue from the body of the worm by a large opening and enter into the crevices of the floor, where they pupate. The pupa is at first light brown, then black and it develops in about 12 days. In order to guard against this insect, breeders protect the worms during the first stages by a mosquito curtain. In Tonking the windows are closed by a fine bamboo network. This fly is in its turn parasitized by *Encyrtus sericophilus* (Hymenoptera), the study of which has been the object of a communication to the Académie des Sciences of Paris.

Another fly, called "rui dâ", which resembles a wasp, attacks the worms when placed on the hurdles to spin their cocoons; its sting is instantaneously fatal, but the damage it does is insignificant.

The silk industry.

Though the industry is established throughout the country it is still in a very backward condition. Spinning in the European fashion is not practised by the natives; there are in Indo-China only three filatures, two belonging to Frenchmen at Nam-dinh (Tonking) and at Phuphong (Annam); the third at Thai-binh (Tonking) belongs to a native company. All three possess improved plant.

The Annamese systems of spinning produce a raw silk unacceptable on European markets.

The unit of cocoons in the filature is the "cân" of 11 lbs.; the unit of weight for the cocoon trade in Tonking is a bundle of 600 "sapeks" ("quan-tiên"), weighing 3.25 lbs., but considered in the French trade as 3.3 lbs. The unit for raw silk in skeins is 10 taels, or 9.25 lbs.

The thread of the cocoon that is formed in damp weather often breaks on spinning; it yields a fluffy silk of inferior quality and is used to adulterate spun silk for export.

The floss is sold to the Chinese, who export it to Cholon, whence it appears a certain quantity is sent to France to the silk by-product factories. It is estimated that in Indo-China the floss pays the labour and the firing in the spinning mills.

The raw silk obtained in Cochin-China is useless in Europe; the "to-lua" or first quality is utilized by the local looms, while the "to-be" quality is exported by the Malays to Bangkok.

Annam silk is exported to Hongkong and Singapore. Tonking silk, which has improved thanks to the combined efforts of the Administration and of the Nam-dinh mills, finds its way in increasing quantities to France, but four-fifths of it still goes to Hongkong.

The native production is very low and is not sufficient for present demands; consequently it does not seek other outlets. Nevertheless the efforts made by the neighbouring countries, especially Siam, the Philippines and Corea, to extend their production, render considerable efforts in the same direction necessary on the part of Indo-China. But there are still great obstacles to be overcome: 1) the lack of a technical direction sufficiently endowed by the administration; 2) the want of European factories in Cochin-China and in Cambodia; 3) the ignorance of the natives in general and especially of the spinners, and their lack of initiative; 4) the want of capital, interest on which is almost always 50 per cent. and upwards, often reaching 100 per cent.

The first steps towards progress must be made by the administrative authorities. The following would be useful measures:

1. Promoting in Cochin-China and in Cambodia the formation of native societies for reeling silk, under the technical direction of French officials. Such societies have given excellent results in Tonking.

2. Providing the natives with improved spinning apparatus, as has already been done in Tonking, and granting prizes either to the spinners or to the exporters according to experience.

3. Teaching the Annamese to reel off a fixed number of threads with knolled ends, replacing bamboo reels by aluminium ones, increasing the twist and adjusting better the motion of the combs. A great deal of tact and a full knowledge of the industry are necessary in the officials who are to induce the natives to adopt these measures, which would considerably increase the value of Indo-Chinese silks even on Asiatic markets and procure profitable sales for raw silks.

4. The awarding of prizes in money and honours by the Government.

Native weaving. — Silk is woven everywhere in Indo-China, but the processes are not equally developed in all centres; Tonking and Annam are more advanced than Lower Cochin-China.

In Tonking weaving is especially prosperous in the provinces of Nam-dinh, Thái-binh and Kiên-an. Dô-son is renowned for its silks, a kind of taffeta called "lua"; in the province of Hà-dống the village of La-ca is distinguished for its gauze called "the La-ca". With the exception of the gauzes, taffetas, serges and satins which compete with the same Chinese woven goods, the natives turn to China for their finest garments. Of all Indo-Chinese countries, Cochin-China is the one which consumes the greatest quantity of Chinese silks.

In Annam, fine satins, gauzes and crapes are woven at Binh-dinh. The importation into France of Binh-dinh crapes continues to increase.

In Cochin-China weaving is limited to plain silks and some taffetas with very small patterns. The most important looms of Cochin-China and Cambodia are those of the orphanage of Cu-lao-giêng, managed by the Sisters of the Apostolic Mission: here taffetas are made with patterns of Cambodian or Siamese style, 28 and 32 inches wide, as well as crapes (foulards and shawls) with French hand embroidery. Tissues of the same kind are manufactured by the Malay cantons of Xom-châ-và (or Xom-châu-giang) over against Châu-doc. The same Malays excel in the manufacture of "sampots" called "chàng hung" (a special kind of taffeta).

Indo-Chinese mulberries: their diseases and pests.

The mulberry cultivated in Indo-China is the white mulberry. There are many varieties of it, which have not yet been studied from the botanical or the nutritive point of view. The native varieties may be reduced to four: "dâu-tau", with leaves cordate, thin, entire or lightly serrate; "dâu-phung", with trifid leaves; "dâu-se", small cordate leaves; "dâu-thù-du" (papaw mulberry), with leaves deeply divided, somewhat like those of the papaw.

Enemies. — In the mountainous region of Châu-doc, where the mulberries are grown as standards, occurs a longicorn beetle, the larva of which

bores holes in the trunk ; this insect has no special name among the Annamese ; the perfect insect gnaws rings in the bark of the branches.

The writer found in 1908 in the province of Ben-co some mulberries suffering from the attacks of an aphid lodged in the underground parts of the tree between the bark and the wood : the bark dries and falls off the parts attacked.

Termites cause serious damage to the mulberries planted on the dunes, called " giông ".

The mulberries on the banks of the Mékong at Tân-châu are attacked every year in the dry season by a fungoid disease which curls up the leaves and dries them, rendering them useless. The trunks of the trees attacked show swellings and become brittle. The natives do not do anything to combat the disease, which disappears as soon as the rains come.

840 - **Fraudulent Introduction of Dead Lobsters in the Parcels sent to Market by Certain Breeders.** — JUGEAT in *L'Hygiène de la viande et du lait*, Year 8, No. 7, pp. 341-343. Paris, July 10, 1914.

FISH
BREEDING.

The wholesale death of lobsters caused in the breeding basins by the variation in the salt content of the water due to accidental infiltration of fresh water, causes considerable losses to the breeders, a certain number of whom do not hesitate to mix these dead lobsters with the live ones in the parcels they send to market, especially to Paris, where the writer on one occasion seized no less than 295 lbs. of them. The flesh of these animals is of a very inferior quality; it is lean, dry, friable and tasteless; it turns to pulp on being cooked and putrefies rapidly. It is therefore important to recognize such lobsters at once. Their characters are as follows :

1. *External characters.* — The muscles are completely relaxed, the membranes of the articulations are thick, dull and whitish (instead of being thin, shiny and transparent) and turn black in a few hours.

2. *Internal characters.* — The tissues are soft and swollen with water; if a membrane be cut, water flows from the aperture, which never occurs when the animal is taken alive from the breeding basin.

FARM ENGINEERING.

841 - **Trial of Machine Ploughing in Rice Fields.** — TARCHETTI, A., in *Il Giornale di Riscicoltura*, Year IV, Nos. 5, 7 and 8, pp. 65-80, 103-107 and 122-128, Vercelli, March 15, April 15 and 30, 1914.

AGRICULTURAL
MACHINERY
AND
IMPLEMENTS

The Italian Experiment Station for Rice Growing at Vercelli organized a trial of machine ploughing in ricefields which took place on March 30, 1914, at Sig. Eusebio Saviolo's estate at Sali Vercellese, near Vercelli. Upwards of 64 acres of land were placed at the disposal of the Committee ; the fields were very uniform and large, so that the average length of the furrows was about 1000 feet, and the plot assigned to each machine about 7 ½ acres.

The following eight machines were admitted to the competition :
A. Motor-hauled ploughs BARONCELLI, of Ravenna, Italy ; FERRETTI GOGGIA, of Tortona, Italy.

B. Self-contained motor ploughs PAVESI TolOTTI, of Milan, Italy; STOCK, of Berlin, Prussia.

C. Cable-hauled ploughs CASALI, of Suzzara, Italy; SANTACHIARA, of Reggio Emilia, Italy; VIOLATI-TESCARA, of Ariano Polesine, Italy.

D. Rotary digger V. MEYENBURG, of Bâle, Switzerland.

1. *Baroncelli's motor*. — 24 H P. (effective), 800 revolutions per minute, total weight 3960 lbs. — Has been somewhat modified to meet the special requirements of rice fields; the diameters of the wheels have been increased, as well as the breadth of their tyres.

2. *Ferretti-Goggi motor*. — 24 to 30 effective H P., 500 revolutions per minute, total weight 9 900 lbs. — Its wheels are on the Lefebvre or Holt Caterpillar system; that is they run on an endless chain of steel plates.

3. *Pavesi and Tolotti's "moto-aratrice"* or self-contained plough. — 16 to 20 effective H P., 700 to 800 revolutions per minute, total weight 4180 lbs. — In this machine the steering wheel has been enlarged and all the tyres have been widened.

4. *Stocke's motor plough*. — 42 to 50 HP, 700 revolutions, total weight 11 000 lbs. — This machine has also been somewhat modified in view of the special work before it.

The three cable-hauled machines (5, 6 and 7) are all on Howard's single-engine system, with a separate windlass bearing two drums and a cable running round the field, though they differ in the construction of the windlasses and in other particulars.

5. *Casali's apparatus* was presented with a 13 effective HP, heavy oil motor, built by the National Gas Engine Co. (Ashton); the two-wheeled windlass truck, with 1600 to 2000 feet of wire cable, weighs 3 550 lbs.

6. *Santachiara's* windlass was presented with a Garret 12 effective HP steam engine; it is mounted on a four-wheeled truck and weighs, with 1600 feet of wire cable, 3960 lbs.

7. *Violati-Tescara's* outfit was entered with two different motors: one is a heavy oil Mietz and Weiss 25 effective HP motor, and the other an electric three-phase motor of the same horse-power.

8. *Meyenburg's rotary digger*. — 25 effective HP, 1000 revolutions per minute; the drum bearing the diggers makes 180 revolutions per minute. Its total weight is 4400 lbs. and its breadth of work 6 ½ feet.

Of the above outfits, Nos. 3, 4 and 8 require only one man to work them, while Nos. 1 and 2 require two men and Nos. 6 and 7 require four.

All the machines entered finished off the work allotted to them, except the electric motor of No. 7, which did not arrive in time for the trial of March 30.

The points given by each of the 19 judges were 70, distributed as follows:

- 20 for quality of the work done
- 20 " cost
- 10 " ease and safety of handling and transporting
- 10 " regularity of work of motor and suitability to other purposes
- 10 " construction and solidity.

The following were the awards :

Group of cable-hauled outfits:

CASALI	1 222 points
VIOLATI-TESCARA	1 215 "
SANTACHIARA	1 102 "

Group of direct-traction outfits:

BARONCELLI	1 170 points
STOCK	1 108 "
PAVESI-TOLOTTI	1 051 "
FERRETTI-GOGGI	960 "

842 - **Experience with Motor Ploughs in the Cultivation of Moor Soil.** — *Protokoll der 72 Sitzung der Central-Moor-Commission vom 15-17 Dezember 1913*, pp. 164-202 + 21 figs. Berlin.

In the 72nd sitting of the Central Moor Commission, four members, Dr. Ramm, Herr Volckmann of Kienberg, Herr Schmig of Etzin and Prof. Falke of Leipzig, reported upon their practical experience with motor ploughs. The earliest experiments were those begun in 1907 at Wiesmoor; electric machines were used, as the steam ploughs then existing seemed too heavy. The division of the land to be worked into fields is shown in the accompanying figure. The arrangement of the electric line at right angles to the roads requires long cables, but on the other hand it saves expense on the permanent lines and on the roads. When each machine is provided with 2300 feet of cable, cross-roads are required only every 4600 feet. With steam ploughing the arrangement is the same except that the cross roads with power lines are not necessary.

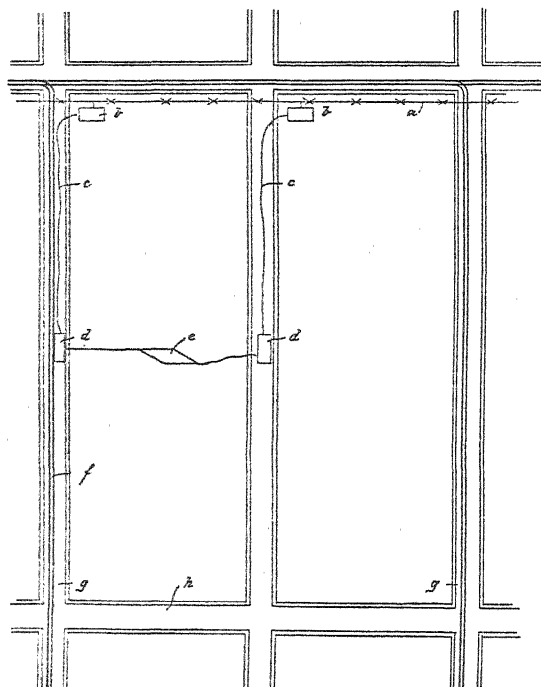
After several trials, satisfactory results have been obtained. Ploughing by electricity costs from 5 s 11 d to 6 s 8 d per acre; a steam engine propelling itself along the moor roads and burning peat costs 5 s 7 ½ d to 6 s 2 d per acre. The lower figures represent the cost with favourable weather and with a long duration of work.

Thanks to the experience gained the windlass (anchor) trucks were constructed in such a way that they did not require a road to be made for them. In order to prevent their being dragged sideways by the powerful strains put upon them they are fitted with large hook-like attachments which press against the side of the ditch on the edge of the field and slide along it like a sledge when the truck moves forward.

As regards the ploughshare, experiments are now being made in order to ascertain whether a share which turns the furrow-slice completely over (which has been found suitable in fens) is advisable for these moors.

Experiments with cable-hauled disk-harrows have been successful and those with rollers also. For roller work, with the exception of that on the rough ploughed land, motor rollers are now used and have proved successful. They can be made heavier at will and are so arranged that they can haul a manure spreader at the same time.

Arrangement of moor land for electric ploughing at Wiesmoor.



EXPLANATION.

- | | |
|-----------------------|----------------------------|
| a. Electric line. | e. Plough. |
| b. Transformer truck. | f. Portable field railway. |
| c. Cable. | g. Sanded road. |
| d. Electric windlass. | h. Road not sanded. |

Each plot measures 550×1540 yds.

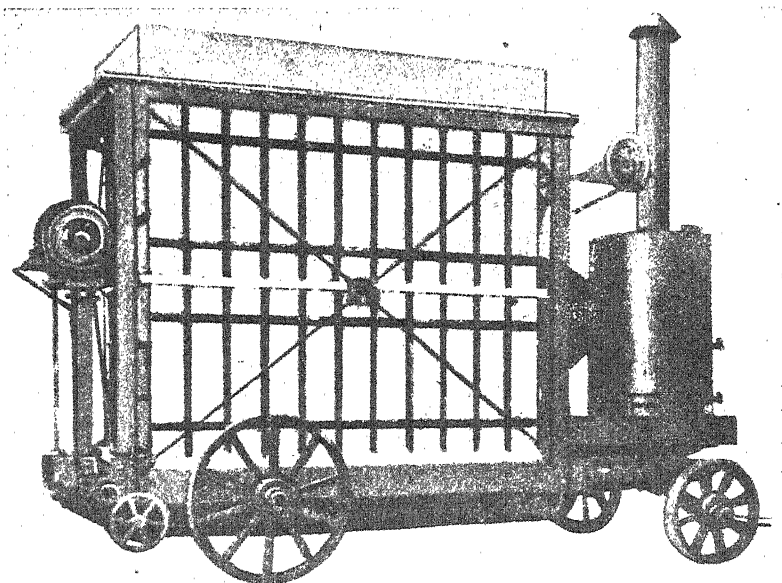


Fig. 1. — Side view of paddy esiccator.

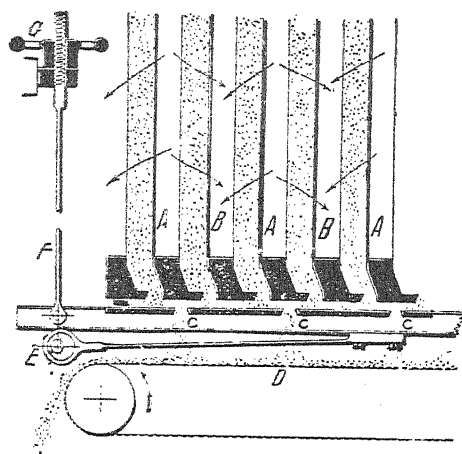


Fig. 2. — Partial longitudinal vertical section of paddy esiccator.

At Kienberg a two-engine Ergomobil plough and a rotary digger have given good results.

At Etzin a two-engine benzine motor outfit has proved very suitable for deep soft moor soil. The 24 HP motors ploughed 0.62 acre per working hour. On dry hard soil, however, the motors are not powerful enough; they should be at least 30 HP.

At Hartenholm the motor plough has been successful on waste land that had been once broken up, but it is not yet known how it would behave on the rough virgin moor.

On the whole the reports show that the efforts for the construction of motor ploughs suitable for moors have yielded good results.

843 - A New Esiccator for Paddy. — TARCHETT I., A., in *Il Giornale di Riscoltura*, Year IV, No. 6, pp. 88-90. Vercelli, March 30, 1914.

A new type of portable paddy esiccator has been designed and built by Geminardi, Guidetti & Co., mechanical engineers, of Vercelli, Italy. A side view of the machine, which is simple and strong, is shown in fig. 1, and part of its longitudinal section in fig. 2.

The paddy is fed from the top into a series of vertical parallel chambers about 2 ½ inches wide and separated from each other by air spaces, A, B, of the same width. The hot air from the generator first enters into the spaces A; as these are closed at the top it is forced to pass through the rice into the spaces B, whence it escapes into the atmosphere. The temperature of the air is regulated by suitable slides in the hot air generator and in the fan.

The dried paddy issues through a slot in the bottom of the vertical chambers and falls onto the horizontal plane, CCC, which moves forwards and backwards by means of an excentric and connecting rod, and thence onto a canvas carrier which delivers it at one extremity of the machine.

The amount of rice passed through the esiccator is regulated by changing the speed of the excentric and by raising or lowering the plane C by means of the screws in G.

The vertical chambers in which the rice is dried are formed by light iron frames on which wire netting is stretched and which slide easily into grooves in the framework of the esiccator.

The machine can hold about 112 cwt. of paddy.

844 - Artificial Hay-Drying. — *The Country Gentleman*, Vol. LXXIX, No. 22, p. 1033. Philadelphia, May 30, 1914.

In many countries a great deal of hay is more or less spoiled or even completely lost every year by the heavy dews and rains of the haying season.

Several years ago T. P. Russell, a Southern Missouri farmer, wrote to the United States Department of Agriculture to ask whether the artificial curing of hay was not an economic possibility. The office of Farm Management began to investigate the question at his farm from 1907 to 1913 and now the problem has been solved.

Hay can be cured at a profit, be it green, half cured or soaked with rain-or dew. Freshly cut grass covered with dew or rain and containing 70 to 80 per cent. of moisture can be cured in 20 to 40 minutes into hay containing 10 per cent. of moisture and this hay can be baled immediately on leaving the kiln and will keep indefinitely.

The above-mentioned office has erected an experimental plant for the curing of hay; it is practically a barn heated by a steam boiler. At one end of the barn is a feeder chute into which the green or wet hay is fed as it comes from the fields. As it enters the chute it is caught on slowly moving belts which carry it round and round the heated interior of the barn, finally bringing it out at the other end cured and ready for baling or for storing loose.

The existing plant is worked at a steam gauge pressure of 80 or 90 lbs., which gives a maximum temperature of 260° F. (126 °C.) at the bottom of the drier, and 223° F. (106 °C.) at the top.

The hay it turns out is superior in colour to field-cured hay and has a very sweet aroma, and in repeated tests the animals before which both kinds of hay were placed ate the former first and often refused the latter.

Analysis shows that the drier-cured hay differs little from the uncured grass and is superior to field-cured hay. The protein content, on a water-free basis, is 19.15 for uncured grass, 18.70 for drier-cured hay and 13.71 for field-cured hay. This difference is partly due to larger leaf content.

Mr. Mc Clure, the official of the Farm Management Office, gives the following estimate for a hay-drying plant capable of turning out 1 ½ tons or more cured hay per hour :

Excavation	\$ 104.00
Kiln superstructure, walls, roof, settings for conveyors, etc. .	\$ 2 160.92
Doors, hinges, guide plates	\$ 233.75
Engine shed	\$ 300.00
Painting and glazing	\$ 281.20
Conveyors, drive, fans, turbine, elevator, regulator, castings boiler and other machinery	\$ 10 422.08
Contingencies	\$ 2 500.00
Total	\$ 16 001.95

Of course no farmer of ordinary means can afford to invest such a sum, but large owners and cooperative associations could easily do so.

As for the cost of artificially curing hay, at the experimental plant in S. Missouri it was found that a ton of cured hay required 1.3 tons of coal. According to other experiments, however, it is asserted that in a 1500-ton drier the fuel requirements would be reduced to 0.6 ton of coal to one of cured hay. The total cost is given in table I.

Considering the advantage of assuring the regular output of crops regardless of weather, and the increased nutritive value of the hay produced by artificial means, it is safe to say that though artificial curing will not take the place of sun or field drying where and when good haying weather prevails, it will enable the grower so to cure his entire crop that it will all grade as "choice" and thus command the highest prices.

TABLE I. — *Cost of artificial hay drying.*

	When a ton of coal costs		
	2.50	3.50	4.50
Fuel cost based on 0.6 ton of coal per ton of cured hay \$	1.50	2.10	2.70
Total labour, interest, maintenance, etc. \$	2.97	2.97	2.97
Total cost of curing from standing grass to baled hay in barn \$	4.47	5.07	5.67
Less cost of curing one ton in field \$	2.60	2.60	2.60
\$	1.87	2.47	3.07

Besides the above investigations, the Office of Farm Management has examined the possibilities of a plant operated by direct heat. The drier consists of a sheet-iron box, 6 by 3 by 3 feet, equipped with a sliding pipe containing damper and thermometer connecting this firebox to the firebox of an ordinary steam boiler. It was fitted with woven wire trays for holding hay and a fan.

With this equipment the drier could be operated up to 700° F. (370° C.), and with an air circulation through the drier up to 4 500 feet a minute. Table II gives the results of experiments with this direct heat drier.

TABLE II.

Velocity of fan discharge	Temperature		Time required to cure	Protein
	Front (1)	Rear (2)		
ft.	deg. F.	deg. F.	minutes	per cent.
3 600	600	250	8	18.81
4 200	640	260	5	17.62
900	450	220	15	17.50
650	400	200	15	19.50
800	400	250	15	18.69
800	350	225	20	17.61
4 200	600	415	15	24.69
2 800	320	200	10	19.75
1 400	320	215	20	20.38
Cured in sun at ordinary temperature (2)				21.31

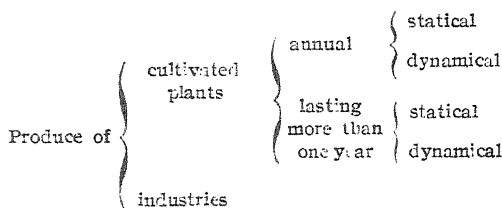
(1) "Front" where the hot air first comes into contact with the hay; "Rear" where the air has passed through the hay and is ready to be discharged from the drier by the fan.

(2) This sample was carefully cured without the loss of any leaves and therefore does not truly represent ordinary field-cured hay.

RURAL ECONOMICS.

845 - **Statistical Research on Farm Produce.** — MARENGHI, ERNESTO. Extract from the "*Giornale degli Economisti e Rivista di Statistica*", Part I, pp. 1-31 + 2 tables. — *Atheneum*. Rome, 1914.

As an introduction to his research, the writer draws up the following scheme of farm produce :



I. — THE PRODUCE OF CULTIVATED PLANTS.

A: The group of statical annual produce. — To this belongs the yield of herbaceous crops, as well as that of woody plants submitted to yearly cultivation, that is subdivided into as many groups of the same age as there are years in the whole cycle of production.

This produce is *statical* on condition that the systems of cropping do not vary. The relative succession of these products may acquire increasing *dynamical* character only if the systems of cropping improve or deteriorate, or if new enemies or modifications of physical environment appear ; but apart from these factors, the annual range of these products represented by a Cartesian diagram gives rise to a broken line, the general trend of which is parallel to the axis of the abscissae. The phenomenon of production of these crops belongs therefore to the group of those which are expressed quantitatively with sufficient approximation by the arithmetical means of a sufficient number of cases. In practice it is suggested to extend the same observation to a period of 10 to 12 years, which is justified also by theory. The writer, however, observes that in periods of very rapid intensification of agricultural production it is well to restrict oneself to the comparison of a still more limited number of terms, because to every successive stage of progress for a given crop a different *normal production* corresponds. The idea of normal production is nothing absolute in itself, as it can only refer to sharply defined conditions of cropping, case by case.

B: Group of yearly dynamical produce. — To this belongs the produce of ordinary woody plants not subjected to yearly management. This produce varies from time to time, not only through accidental causes like the statical, but also as a function of the age of the plantations, giving rise to very characteristic dynamical chronological series which serve for the construction of the law of production concerned. The *normal curve of production* of woody plants varies from case to case as a function of many factors : species of trees, system of management etc. One of the

fundamental aims of economic statistics is that of investigating these curves by suitably applied methodical observation.

With this object the writer proposes to replace *observations in time* which require long periods of time, by *observations in space*, by recording the actual yields of woody plants in similar regions, separately for the plants of each age.

When this observation has been continued for a certain number of years, for instance 10 or 12, there will be sufficient material to determine the normal curve of production, assuming as the normal produce of the n^{th} year of age the average of the produce ascertained on trees of that age during the various years of observation. The series of the normal yields thus obtained is the numerical expression of the normal curve which is sought.

The writer notes that by the same process, in the short space of one year the data sufficient to draw a *gross curve of coexistent yield* may be collected, and that this may lead to the normal curve when the ratio between the actual unit yield of the year under observation and the average of the region under investigation is known. Thus, representing the equation of the gross curve by

$$y = f(x)$$

the normal one will be :

$$y = K f(x),$$

in which K is the ratio defined above. The writer obtains similar results (on the hypothesis that the methods of management do not vary sensibly) with the data of a *gross series of successive yields*, the perfecting of which may be obtained by arithmetical, algebraical or graphical means. The first is the simplest of all: it consists in substituting for every term of the series the arithmetical means of the three, five, seven, etc., terms of which it is the middle one (Wittstein's method). The *algebraical* process consists essentially in replacing the gross curve by a simpler one which it is assumed corresponds to the real law of the phenomena. The problem is solved by causing a curve of a certain order to pass through certain points under determined conditions according to the method of interpolations. The *geometrical* or *graphical* method consists in representing the gross series by a Cartesian diagram and in interpolating in it a curve which approaches the same series and then determining according to scale the values of the ordinates corresponding to the theoretical curve.

The writer then discusses the fragmentary series and the process of interpolation based on the hypothesis, which corresponds with sufficient approximation to reality, that the yield of woody plants varies approximately according to geometric progression provided the intervals considered be not too long and the accidental oscillations be neglected.

This process of interpolation finds its analytical expression in the following formula, which allows the missing data of the series to be interpolated :

$$y = K a^x.$$

in which :

y = average yield of the plant at the age of $\alpha + x$

$K\alpha$ = average yield of the plant at the age of α .

ρ = constant ratio of variation

x = independent variable quantity which gives the age of the plant in any year of the interval considered, supposed to be of n years.

It follows that setting $K\sim$ for yield at the end of the same, the equation

$$K \propto \rho^{n-1} = K\sim$$

is obtained, from which the following results :

$$\rho = \sqrt[n-1]{\frac{K\sim}{K\alpha}}$$

This process of interpolation thus consists in the analytical representation of the production of woody plants bearing annual produce, not by means of a single curve (in which case the approximation would be too wide), but with several and successive branches of curves connected with each other. These may be considered as the expression of as many empirical laws of the phenomenon that is investigated, each of them being, with sufficient approximation, with certain limits of age of the same plants.

The exactness and the value of the process of interpolation may be experimentally checked when suitable statistical data are available.

The writer notes in this connection the low trustworthiness of the statistical data existing as to the curves of production of woody plants bearing yearly produce, and the necessity of systematic observations of the same in order to collect valuable material for the solution of the most varied economic problems.

C: The group of polyannual produce. — To this belongs the principal production of woods not under regular rotation. These woods are either high forest, in which case the cycle of the formation of the product coincides with that of the plant, or they are coppice, and then it is a submultiple of the latter. The distinction is of a certain importance for these statistical researches, since high forest gives rise to a *chronological series of statistical produce*, whilst coppices — at least in some cases — gives rise to *dynamic series*.

The data that are necessary and sufficient to individualise the fundamental production of woods are two: the *physical quantity* (discriminated if necessary in selected groups or otherwise) and the *extent of the corresponding cycles of elaboration*, which are not fixed as they are for the annual products, but are susceptible of being varied within certain limits with the object of realizing a maximum profit, other conditions being equal. Thus the curve of the increment of wood in forest plants is characterized by the progressive decrease of the rate of increment; during this progressive diminution the limit of profitableness is reached when the rate of wood increment expressed in money coincides with the rate of interest.

D; The indices of variability of crops and the ways of determining them. A crop, other conditions being equal, presents less risk the steadier its productivity, which is expressed by suitable figures called *indices of variability*. One of the indices most frequently used for statistical series is obtained by dividing the square of the mean deviation of the mean of the fields during the various years of observation from the arithmetical mean of the whole period by this latter mean.

The writer notes that these indices of variability are not liable to generalization but are strictly connected to the special conditions of environment and proves by means of suitable examples that the range of the yield of the same crop varies within very wide limits from one locality to another as a function of many circumstances.

II. THE PRODUCTS OF AGRICULTURAL INDUSTRIES WHICH RESULT IN A MORE OR LESS ELABORATE TRANSFORMATION OF CROPS.

The ratio (at least approximately) between them is *constant* in some cases and *variable* in others. It is constant, for instance, in the transformation of grapes, olives etc., but variable in that of forage crops. The statistical investigations to be carried out in the first case are not many, it being enough to determine the coefficient of *yield per unit*. If this ratio is variable the *law of variation* has to be sought according to the systems of methodological statistics.

The writer restricts himself to a consideration of the production of milk and of meat.

The production of milk varies — for every individual kind of cow — according to many factors: breed, age, diet, stage of lactation, etc. In order to get the principal characters of the process, a sufficient number of animals have to be subjected to experiment and they have to be grouped according to age, diet, or other factor, in agreement with the problem to be solved. Supposing the factor considered be age, the average individual yield of the animals under observation will have to be determined for each class of age. The series of average yields obtained will give the curve of the facts as functions of the age; this can be further simplified by transforming the individual terms in index numbers, that is by making the first term equal to 100 or 1000 and reducing the others in proportion.

The writer reports some data collected on a group of Simmental cows and notes that the general trend of the curve of the annual individual mean shows a certain analogy to what is observed in the production of woody plants bearing fruit yearly.

The writer examines similarly the influence of the time that has elapsed from the beginning of the lactation on the yield of milk, and from the individual chronological series obtained from a Swiss cow belonging to the Perugia Agricultural Institute he finds the corresponding normal curve by means of a suitable process of equalizing. The production of milk in the months following calving diminishes very nearly in geometrical

proportion and consequently the normal curves may be represented analytically by functions of the type of:

$$y = p_1 \rho^{x-1}$$

in which

y = milk yield of any month x .

p_1 = milk yield of the first month after the birth of the calf.

ρ = a constant ratio to be determined either by the method of the least squares or, simpler still and with sufficient approximation, by taking the average of the actual ratios which are obtained by dividing every term by the one which precedes it.

In a special table the writer compares the actual series of a group of Swiss cows with the theoretical series and notes that the agreement between the two is more than satisfactory. Even on the hypothesis that the actual series should present some gaps, the ratio ρ of variations could be equally determined (though less exactly) and the analytical formula could be found, and it would among other things allow the whole series to be reconstructed and the total corresponding yearly production to be determined.

Submitting to a similar process some data relating to the production of flesh, the writer notes that the series of the increments of weight per unit in young and in adult animals in course of being fattened gives rise to a descending curve which turns its convexity to the axis of abscissae and which may be represented — as in the case of milk yield — by an equation of the type of:

$$y = p \rho^x$$

The development of animals by weight follows the economic law of increasing production. A gradually diminishing increment by weight corresponds to an increasing consumption of fodder. Admitting as a fairly probable hypothesis that the rations of animals are homogeneous for every group and directly proportional to their weight, the writer infers that the above equation represents also the action of the said law as regards the production of flesh.

846 - **The Position of Non-Breeding Dairy Farms in Modern Agriculture.** — BRINKMANN, THEODOR, in *Führlings Landwirtschaftliche Zeitung*, Year 62, Part 13, pp. 433-449. Stuttgart, July 1, 1914.

The subject of dairy farms which do not breed their cows, especially in their importance from the point of view of social economy, is much discussed at present. The writer studies the problem exclusively from the point of view of rural economy and proposes to answer the two following questions:

1. Is it justifiable from the economic point of view to keep dairy cows without breeding them, and if so under what general conditions is this to be preferred to dairy farming with breeding?

2. What are the effects of the present changes in the conditions of the industry and of agricultural production upon the profitableness of the

two rival systems? Do they affect both systems equally or do they favour one more than the other?

I. — Both systems are intended to utilize to the utmost the fodder produced on the farm itself, and this especially by transforming it into milk. The non-breeding dairy farm can, with the same quantity of fodder, produce much larger quantities of milk than the breeding dairy farm, because the former keeps only milk-producing animals; further it possesses another advantage from the point of view of the utilization of milk in that while in the breeding farm a part of the milk produced is consumed by the calves, the other type can utilize at will all the milk that it produces and may besides regulate its production to suit the demands of the best possible utilization. These advantages ensure the non-breeding dairy farm gross returns in money which are fairly high in comparison to the quantity of fodder to be utilized. This, however, cannot be obtained without a relatively high cost of production, caused especially by the loss, which in general is considerable, entailed by the purchase and sale of cows, by the necessarily intensive feeding and great consumption of concentrated foods, by the relatively high price of labour and by the considerable risk attendant upon the continual purchase of strange cows.

From these considerations it is evident that the conditions which justify the existence of non-breeding dairy farms are present when it is possible to utilize the large quantities of milk produced in the farm in such a way that the receipts balance the high cost of production. If the price of the milk increases gradually, a point must be reached at which the advantages given by the high gross yield are superior to the disadvantages caused by the high cost of production. This is clearly shown by Table I (1), in which the yield in milk and the gross returns in cash for the different prices of milk have been calculated, then the cost of keeping the cattle, that of the concentrated foods and lastly the difference between gross returns and outlay, that is the net returns obtained by utilizing the fodder at the different prices of milk, referring all the figures to 100 kilos (220 lbs.) of starch value of the fodder produced in the farm itself. These calculations have been made for three different groups of farms: 1) dairy farms which do not breed their cows; 2) dairy farms which breed a part of their young stock; 3) dairy farms which breed all their stock.

The division of labour which exists under these two systems of dairy farming is thus perfectly justified as an economic necessity, as a consequence of the variations, from one farm to another, of the net returns obtained by the utilization of milk. After all the problem of the non-breeding dairy farm is only a question of the price of milk. Nevertheless the conclusion cannot be drawn that a limit of fixed profitability, true under all conditions, can be established between the two systems; on the contrary, the deciding limit in the price of milk must be determined separately in each case, as it depends upon the special conditions of each farm:

(1) This table is taken from FUNK: Die landwirtschaftlichen Betriebsverhältnisse der bauerlichen Milchwirtschaften im Havelland. — *Arbeiten der D. L. G.*, Part 169.

TABLE I. — 100 kg. (220 lbs.) of starch value of the

	Number of farms	Gallons	I. Supply									
			Gross receipts in cash when the price of milk per gallon is:									
			<i>d</i> 6.44		<i>d</i> 7.48		<i>d</i> 8.56		<i>d</i> 9.60		<i>d</i> 10.72	
			<i>s</i>	<i>d</i>	<i>s</i>	<i>d</i>	<i>s</i>	<i>d</i>	<i>s</i>	<i>d</i>	<i>s</i>	<i>d</i>
In dairy farms which do not breed	23	50.25	26	9 ³ / ₄	31	3 ¹ / ₄	35	9	40	2 ³ / ₄	44	8 ¹ / ₄
In mixed dairy farms. . . .	21	45.50	24	4	28	4 ³ / ₄	32	5 ¹ / ₂	36	6	40	6 ³ / ₄
In breeding dairy farms. . .	13	34.75	19	2	22	4 ³ / ₄	25	6 ³ / ₄	28	9	31	11 ¹ / ₂

its size, the quality and quantity of the fodder to be utilized, the requirements as to the production of farmyard manure, the professional capacity of the farmer and the amount of his capital. In general it may be said that the conditions to warrant the division between the two systems exist only where the milk is sold as such.

II. — It is evident that in the course of time the limits of the areas occupied by each system shift in consequence of the changes which occur in the conditions of profitability. The expenses due to certain factors of production, chiefly those which weigh heavily on farms that do not breed, have increased considerably of late years. This is especially the case with concentrated foods and the losses caused by restocking the stables, and with the price of labour.

On comparing the average prices of the two periods 1901-03 and 1909-12, an increase of 14 per cent. is found in the price of earthenware cake, 12 per cent. in cotton seed, 17 per cent. in coconut cake, 18 per cent. in wheat bran and 23 per cent. in brewer's grains. The increase in the price of labour and the decrease in the quality of the work done are notorious. The increase of the cost of concentrated foods and of other expenses weighs also on the budget of breeders, but not so heavily as on the non-breeding dairies, which spend almost twice as much as the former on concentrated foods (see Table). Furthermore there has been, since 1900, a rapid rise in the prices of milch-cows, amounting to £ 5 to £ 6 per head in the Rhine Province. Though the increase in the price of milch-cows has been partly balanced by the increase in the prices of fat cattle, this rise in the price of cattle weakens considerably the position of non-breeding dairies, for in the competition between the two systems the increase in prices injures the one and benefits the other, since the high prices paid by the non-breeding dairies are an advantage to the breeders.

It is undeniable that of late years there has been a considerable increase in the sale price of milk, but according to the writer the consequent increase of the gross returns has not been sufficient to counterbalance the

fodder produced on the farm (hay, straw, mangolds, etc.)

II. Require the following expenses									III. Yield a net profit when the price of milk per gallon is:									
for labour, interest, amortizement of working capital, depreciation of stock			for purchase of concentrated foods			Total			d 6.44		d 7.48		d 8.56		d 9.60		d 10.72	
s	d	per gal.	s	d	per gal.	s	d	per gal.	s	d	s	d	s	d	s	d	s	d
8	3 ¹ / ₄	1.96	13	7 ¹ / ₂	3.28	21	10 ³ / ₄	5.24	4	11	9	4 ¹ / ₂	13	8 ¹ / ₄	18	4	22	9 ¹ / ₂
7	3 ¹ / ₂	1.92	10	6 ¹ / ₂	2.80	17	10	4.72	6	6	10	6 ³ / ₄	14	7 ¹ / ₂	18	8	22	8 ³ / ₄
6	4 ³ / ₄	2.16	5	3 ¹ / ₄	1.76	11	8	3.92	7	6	10	8 ³ / ₄	13	9 ³ / ₄	17	1	20	3 ¹ / ₂

increased cost of production. And if such were really the case the considerably increased chances of profit in breeding caused of late by the conditions of the market would always signify a sensible loss for non-breeding dairy farms. The fact is that during the last ten years the profits of cattle breeding farms have considerably increased, both absolutely and also relatively to those of non-breeding dairy farms; it is this latter fact which settles the matter, because the question of the profitableness of a branch or a system of farming does not depend upon this branch or system paying its expenses absolutely, but rather upon its bringing in more profit than any other branch which might replace it.

The weakening of the position of non-breeding dairy farms will be still better understood when it is considered that the technique and the improvement in the means of communication and other factors tend always more to abolish the monopoly in the supply of fresh milk which formerly belonged to the districts of production nearest to the markets. Many and various circumstances concur in rendering easier the supply of milk to the centres of consumption, such as the facilitations offered by the railways for the carriage of milk, the better preservation of fresh milk due to systematic treatment, the ease with which milk can be obtained from distant districts thanks to a series of organizations of producers, traders and sometimes of consumers; all these factors and others also act in the same sense, favouring the offer of milk and opposing the increase of its sale price, increasing the utilization price in new districts of production and decentralizing the production of fresh milk. The creation of new districts of supply tends to equalize the local prices of milk and the intensity of production in the districts of supply. Those that are situated at greater distances may adopt a more intensive system; all of them, however, approach an average line in their degree of intensity. Thus, the farms which are intermediate between the non-breeding ones and those which breed all their stock are especially favoured by recent developments and will increase in importance.

847 - The Organization of Team Work according to the Results of Bookkeeping and to Net Returns. — OSTERMAYER, ADOLF, in *Mitteilungen der landwirtschaftlichen Lehrkanzeln der k. k. Hochschule für Bodenkultur in Wien*, Vol. II, Part 3, pp. 411-431. Vienna, 1914.

The expense for the work done by draught animals is a large item in the total working expenses of a farm. Calculated on the results of book-keeping they have been found to be as follows, when expressed as percentages of the total cost of production.

For cereals. . . .	{	in the plains. . .	11.0 %
		in the mountains .	17.2 »
For beets	{	in the plains. . .	24.9 »
		in the mountains .	28.2 »
For potatoes. . . .	{	in the plains. . .	19.9 »
		in the mountains .	18.3 »
For hay	{	in the plains. . .	13.5 »
		in the mountains .	11.4 »

The range of the amount of these expenses exerts a great influence upon the net returns of the whole farm, as the writer proves with the aid of the books of 61 Moravian peasant farms. The average net return of these 61 farms is 19s 11 $\frac{1}{2}$ d per acre and corresponds to a rate of interest of 3.5 per cent. on the average capital of £28 4s 0 $\frac{1}{2}$ d per acre. This result has been obtained at the average cost of 2s 11d per day's work per animal and an average number of 4.66 days per acre, which brings the expenses of team work to 13s 8d per acre. With the help of these figures the writer calculates the net returns which correspond to the range in the cost of the day's work of the animals from 2s 1d to 3s 11 $\frac{1}{2}$ d.

	s	d		£	s	d
When the work day costs	2	1	the net returns are	1	3	8 $\frac{1}{2}$ per acre
» » »	2	6 $\frac{1}{2}$	» » »	1	1	8 »
» » »	2	9 $\frac{1}{2}$	» » »	1	0	5 »
» » »	3	2 $\frac{1}{2}$	» » »	1	8	6 »
» » »	3	5	» » »	1	7	7 »
» » »	3	10	» » »	1	5	9 »
» » »	3	11 $\frac{1}{2}$	» » »	1	5	2 »

Among the components of the cost of the work of draught animals, the cost of feed and wages exert a decisive influence, as may be seen from Table I, in which the total cost of the day's work of an animal has been divided into its component parts for three groups of farms, each of them presenting different amounts for the keep of their draught animals.

TABLE I. — *Composition of day's work of teams.*

Group	Average cost of a day's work	Daily outlay						Partial items in percentage of total outlay				Actual number of work days out of 100 available days	
		Fodder	Labour	Amortizement and interest	Sundries	Total		Fodder	Labour	Amortizement and interest	Sundries		
	s	d	s	d	s	d	s	d	%	%	%	%	
I	2	3½	9	6	¼	1½	1	4¾	53.6	34.6	2.4	9.4	60.9
II	2	8	10½	2	1	1	1	2½	70.7	14.1	6.9	8.3	45.8
III	3	8	11½	5½	1	1	1	7	58.9	28.6	5.8	6.7	43.1
Average . .	2	11	10½	4½	1	1½	1	5½	60.8	26.1	5.1	8.0	46.5

Table I shows also that the cost of an animal's day's work does not always follow the cost of keep, because it depends also to a great extent upon the degree of effective utilization of the draught animals. Consequently this utilization has a great influence on the net returns, as may be seen in Table II, which shows the average net returns of several groups of farms arranged according to the degree of effective utilization of their teams.

TABLE II. — *Average net returns of groups of farms arranged according to the degree of effective utilization of their draught animals.*

Group	Small farms		Medium farms		Large farms	
	Degree of effective utilization	Net returns per acre	Degree of effective utilization	Net returns per acre	Degree of effective utilization	Net returns per acre
		£ s d		£ s d		£ s d
I	98.3	1 15 4	72.5	2 10 7	62.2	1 14 0
II	76.3	18 7	54.7	1 13 10	48.5	1 13 6
III	51.9	9 10	36.8	1 4 1	41.5	1 8 0

The same results are obtained by grouping the farms according to their net returns and calculating for the groups thus formed the average effective utilization of the draught animals, as in Table III.

TABLE III. — *Average utilization of draught animals by groups of farms arranged according to their net returns.*

Group	Small farms		Medium farms		Large farms	
	Net returns per acre	Degree of effective utilization	Net returns per acre	Degree of effective utilization	Net returns per acre	Degree of effective utilization
	£ s d	%	£ s d	%	£ s d	%
I	2 5 11	95.8	3 17 3	58.7	3 8 3	51.0
II	0 18 8	82.2	1 12 6	54.0	1 0 11	55.0
III	—0 7 1	70.9	—0 4 4	53.1	0 2 0	47.1

With one exception the net returns diminish with the degree of effective utilization, so that the most intense and regular utilization of the available draught animals is a fundamental factor for obtaining satisfactory net returns.

Nevertheless in organising the work of draught animals there is another problem also to be solved, namely that of suiting the animals to the needs of the farm, not only according to their number but also according to the different kinds of draught animals. As such, horses, oxen and cows may be considered, and they differ from each other by their individual characters, pace, intelligence, facility of being driven, etc., and by the cost of their keep. The writer calculates the influence of the size of the farm, of its situation, of the intensity of farming, of the intensity of hoed crops and the outer and inner means of communication, on the conditions of the work of the draught animals in the 61 Moravian peasant farms, and illustrates by means of diagrams the employment and the degree of utilization of the different kinds of draught animals in the farms, divided into two groups according to the amount of the net returns. The results of these calculations are set forth in Table IV.

In small farms the great use of the cow as a draught animal is very advantageous; a too liberal use of horses and oxen causes a decrease in the net returns; on the other hand in large farms the work of horses is very advisable and it should be completed by that of oxen only to a limited extent, because large farms require team work more continuously than small farms and horses are more suitable than cattle, and especially cows, to continued work.

In well organized mountain farms the work of horses is much employed, to a lesser degree that of oxen, while cows are only used as a temporary reserve during the busiest time in the summer. The increase of the number of oxen and the simultaneous reduction in the number of horses causes a decrease of net returns. Similarly in the plains the best utilization of the draught animals is obtained only by the supplementary use of the labour of oxen, though the number of horses is by far superior to that of the oxen. The organization of the team work in intensive farms with high net returns resembles very closely that of well managed plain farms,

TABLE IV. — *Work-days of horses, oxen and cows under various conditions.*

		Small farms, less than 24.7 acres	Large farms, over 24.1 acres	Plain	Moun- tain	Inten- sive	Inten- sive	Exten- sive	Hoed crops		Distance from market		Rounded property and fields near farm	Scattered property and fields far from farm			
									Working ex- penses per acre	under	over	under 3.11 miles			over 4.66 miles		
																over	under 12 %
High net returns	Horse days	545	4 760	5 439	2 640	5 545	1 401	5 174	2 106	1 793	5 093	4 061	4 652				
		401	2 477	2 997	1 679	3 160	946	2 791	1 339	1 179	2 966	2 314	2 977				
	Ox days	0	533	800	274	640	1 372	457	593	946	355	0	0				
		0	158	238	103	190	414	136	224	355	165	0	0				
	Cow days	2 130	0	0	637	152	856	108	976	961	84	249	0				
		2 130	0	0	637	152	856	108	976	961	84	249	0				
Low net returns	Horse days	1 772	3 581	5 605	2 558	4 751	3 356	3 546	3 191	2 506	2 517	1 579	2 928				
		742	1 724	2 975	1 164	1 985	1 472	1 360	1 143	1 596	1 332	799	1 240				
	Ox days	1 797	0	0	1 409	531	1 175	442	2 097	0	1 839	1 908	243				
		854	0	0	661	359	545	299	997	0	883	785	83				
	Cow days	1 859	2	0	782	886	0	1 364	909	750	492	922	610				
		1 859	2	0	782	886	0	1 364	909	750	492	922	610				

(1) As the cows' keep is not to be debited to the labour account except when the cows actually work, the available cow days have been put equal in number to those effectively utilized.

because the good climatic conditions and the fertile plain land lead to an intensification of farming. It is a mistake to make much use of cows as draught animals in intensive farms and it reduces the net returns. Nearly the same results are obtained by grouping the farms according to the intensity of the hoed crops.

It follows that the horse may be considered as the draught animal *par excellence* for intensive farms. On the other hand well managed farms under extensive cultivation show a remarkably small use of the horse and a notable preference for the work of cattle, both oxen and cows, and it is especially in farms with not much land under hoed crops that the work of cows is prevalent. Errors of organization in this case are the prevailing use of horses, which are insufficiently utilized, and the neglect of cows, which are the most suitable draught animals for extensive farming.

Farms near the markets can utilize cattle to a greater extent than those situated further off, notwithstanding the constant tendency towards the intensification of culture, and without diminishing their net returns; they are even forced to do so in order to utilize regularly their draught animals. Indeed the necessity of a good deal of carriage is a factor of an equal distribution of animal labour, inasmuch as this transport work may generally be performed at the times in which work is slack on the farm. This explains the great amount of horse labour in farms at a distance from markets and yet yielding considerable incomes.

It is the same with the distance between the fields and between these and the farm. A very small distance or none at all favours the intensification of culture and leads to the prevalent work of horses, completed by that of oxen and cows, with a view to equalizing the distribution of the work. The use of horses becomes still more prevalent in those farms in which the fields are wide apart and distant from the farm itself. This group of farms is the only one which still gives high returns while using only horses as draught animals; this is explained by the time saved by the quick pace of the horses in covering the above distances. In these conditions the use of cows would be an error.

From what has been said it appears manifestly that in organizing the work of the animals of a farm the capability and the characters of the different draught animals employed are the basis on which they are to be chosen. It is only by combining and completing reciprocally the work of the various animals in harmony with local conditions that it can best be utilized with the object of keeping the cost of production low and of obtaining high net returns.

The writer demonstrates the truth of the above by means of diagrams containing for the previously mentioned 61 farms, divided into two groups according to the amounts of net returns, the curves of the horse, ox and cow days, per week and per 100 acres of area of cultivated land. These curves are compared with each other and with the line representing the annual average of the work days, expressed in horse-days per week, in the farms yielding high net returns.

848 - **Investigations into the Profitableness of Fen Cultivation.** — FRECKMANN, W., and SABOTTA, in *Landwirtschaftliche Jahrbücher*, Vol. XLVI, Part 2, pp. 275-326. Berlin, 1914.

The writers endeavour to solve the problem of the profitableness of fen cultivation on the basis of the experience collected during ten years of work at the Neu Hammerstein Moor Experiment Station, with the help of the data contained in the literature on the subject. In the first place they try to determine the capital that is necessary for such undertakings and then they discuss the ratio between the purchase price of the bare fen and the capital required for improvements. They estimate the capital for buildings for all kinds of farming at the average figure of 25 per cent. of the total value of the land.

In the calculation of the profitableness of the regularly installed fen farm, there is no question of ascertaining the amount of expense for each unit of the original acreage, but of determining the extent of utilisable areas after the improvements have been carried out, as well as the cost of purchase and improvement of the unit of productive surface of fen in order to know the interest that it bears. Draining by means of open ditches means a considerable loss of area. The writers calculate the amount of this loss, and the capital represented by the Neu-Hammerstein fen farm, as follows :

Unsanded meadows.

A) <i>Drainage by open ditches :</i>		£	s	d
1. Preparatory work per acre		1	19	8
2. Drainage by open ditches		1	6	9
3. Work on the slopes and sowing			6	4
4. For the main drainage canal			3	2
5. For roads			1	11
Total per acre of original area . . .		£3	17	10

For one acre of cultivable surface the cost of cultivating is as follows :

1. Preparatory work, draining, main drain, and roads per acre of cultivable land, with a loss of 2.25 per cent. or	£3.17 0 0.9775	3	19	9
2. Ploughing (8 inches) including hoeing		1	11	9
3. Disk-harrowing			19	0
4. Manuring :				
a) 6.37 cwt. kainit, 4.78 cwt. basic slag, including haulage		1	1	1
b) Mxing, carting and spreading			2	4
5. Sowing :				
a) Rolling			1	2
b) 9 ½ lb. clover and grass seeds		1	7	11
c) Sowing				9
d) Rolling with light roller			1	2
Total . . .		£9	4	11
Purchase value £11 18s per acre of bare fen: cost of cultivable area	£11 18s 0.9775	12	3	6
Cost of buildings per acre			7	18 9
Total cost per acre of cultivable area . . .		£29	7	4

B) *Drainage by fascines :*

1. Preliminary work.	1	19	8
2. Drainage by fascines	2	7	8
3. Main drainage canal	3	2	
4. Roads	1	11	
Total per acre	<u>£4</u>	<u>12</u>	<u>5</u>
5. Ploughing and hoeing.	1	11	9
6. Disk-harrowing.		19	0
7. Manures, carting and spreading	1	3	6
8. Sowing	1	11	1
Total . . .	<u>£9</u>	<u>17</u>	<u>9</u>
Purchase value	11	18	0
Buildings	7	18	9
Total . . .	<u>£29</u>	<u>14</u>	<u>6</u>

In this way the writers calculate the cost of purchase and improvements per unit of area of the meadows and arable land and come to the following results (Table I).

In preparing sanded fen cultivation it is generally much more advantageous to bring the sand from outside rather than to excavate it from the subsoil of the fen, because a layer of 5 inches taken from the subsoil would cause an average loss of area of 20 per cent.; the consequent increase of the cost of installation per acre of cultivable surface would equal the cost of getting the sand from a distance of 2 660 yards, so that up to this distance this means must be preferred. There is the further reason that the subsoil sand is often exceedingly fine and harmful.

An argument in favour of underground drainage is that it avoids loss of surface. Unless special technical reasons, such as the depth and special nature of the fen, or the constitution of the subsoil, or the impossibility of obtaining pipes or fascines at reasonable prices and of conveying them to the fen (often lacking in roads), oblige the open drain to be resorted to, this form of drainage should be avoided.

Besides the financial reasons it must also be borne in mind that open drains in winter do not carry off a sufficient quantity of water, and further that the vegetation on the edges and slopes of the ditches affords protection to animals and plants injurious to crops.

In establishing the cost of producing the several crops the writers include in the general farm expenses: the interest on the instruments of production (live and dead stock and stores), all expenses for management and supervision, for bookkeeping taxes, dues, repairs of buildings and roads, wear and tear of buildings and plant, etc. For the individual crops the following percentage of the gross yield is considered as general expenses: for meadows 12 per cent., for pastures 10 per cent., and for field crops 15 per cent.

In the calculation of the crop returns the writers use figures that are somewhat below the real average yields at Neu Hammerstein, as in Table II.

TABLE I. — *Cost of land and improvements on ten soil (per acre).*

Description of system of cultivation	1	2	3	4	5	6	7
	Value of improvement £ s d	Purchase price of land £ s d	Value of buildings £ s d	Capital (2 + 3) £ s d	Total value (1 + 2 + 3) £ s d	Share of cost of improvement in % of total value	Ratio of purchase price of land to value of improvement
Unsanded meadows, ditch drainage . . .	9 5 1	12 3 6	7 18 9	20 2 3	29 7 4	31.52	100 : 76.02
Unsanded meadows, fascine drainage . . .	9 17 9	11 18 0	7 18 9	19 6 9	29 14 6	33.27	100 : 83.10
Unsanded meadows, pipe drainage	16 16 9	7 18 9	7 18 9	15 17 6	32 14 1	51.47	100 : 212.18
Sanded meadows, pipe drainage	22 7 9	7 18 9	7 18 9	15 17 6	38 5 2	58.52	100 : 282.16
Sanded arable land, ditch drainage. . . .	29 9 1	9 0 4	7 18 9	16 19 1	46 8 2	63.47	100 : 326.64
Sanded arable land, pipe drainage	27 11 1	7 18 9	7 18 9	15 17 6	43 8 6	63.45	100 : 347.25
Unsanded arable land, ditch drainage . . .	10 19 4	8 14 5	7 18 9	16 13 2	27 12 6	39.70	100 : 125.76
Unsanded arable land, pipe drainage . . .	9 1 9	7 18 9	7 18 9	15 17 6	24 19 3	36.42	100 : 114.57

TABLE II. — *Yields of arable crops (lbs. per acre).*

	Sanded land				Unsanded land	
	Actual averages		Figures used in calculations			
	Grain	Straw	Grain	Straw	Grain	Straw
Winter wheat.	3 200	6 900	2 850	4 100	1 750 2 600	3 750 3 400
Rye.	3 000	5 200	2 300	5 200	Spring rye	—
Oats	3 350	4 100	2 500	3 750	—	—
Barley.	2 600	3 350	1 950	3 000	—	—
Horse beans	3 050	7 500	2 300	3 500	1 875	3 000
Potatoes.	28 850	—	17 800	—	16 000	—
Mangolds	60 250	—	53 500	—	53 500	—
Carrots	43 200	—	44 500	—	—	—
Mixed grain and pulse	—	—	—	—	1 875	3 000
Rape and colza.	—	—	—	—	1 425	2 700

On account of the high risk in fen farming of damage from frost and pests, deductions are made in the crop accounts, as shown in Table III.

TABLE III. — *Deductions for risk (% of gross yield).*

	Sanded crops		Unsanded crops
	Open drains	Pipe drains	Open drains
Winter rye.	8	6	20
Spring rye.	—	—	15
Oats.	10	8	—
Wheat.	20	16	—
Barley.	24	20	—
Beans.	12	10	20
Potatoes.	10	10	15
Carrots.	12	12	—
Mangolds.	12	12	20
Pulse.	—	—	22
Rape.	—	—	30

On the above mentioned lines the accounts are kept and their chief results are collected in Table IV.

TABLE IV. — *Net returns of crops on ten soil.*

Crop	1 Total cost of farming	2 Value of actual gross returns	3 Returns after deduction of risk	4 Net returns (3-1)	5 Capital in land	6 Interest on capital in land at 4 %	7 Capital in improvements	8 Interest on capital in improvements		10 Capital value	11 Capital value	
								in £ s d (4-6)	in %			
												According to net returns capita- lized at %
1) Meadows with open ditches	3 16	3 5 11	1 5 11	1 14 10	2 3	16 1 9 5	1 18 9	10.15	5	34 17 6		
2) Meadows without sand	3 0	2 5 19	9 5 19	2 19 8	15 17 6	12 9 16 16	2 6 11	13.95	6	49 14 3		
3) Sanded meadows	2 17	1 6 14	1 6 14	3 17 0	15 17 6	12 9 22 7	3 4 4	14.36	6	64 3 5		
4) Sanded field crops									6	68 11 2		
a. Rye.	5 2	2 10	3 1 9	4 4 9	16 19 0	13 6 29 9	1 3 11 2	12.08				
{ open ditches												
{ pipe drains	5 4	2 10	3 1 9	4 7 3	15 17 6	12 9 27 11	3 17 7	14.10				
b. Oats	5 0	6 11	19 11	10 15 11	5 15 4	16 19 0	1 3 5 11	17.30				
{ open ditches	5 2	6 11	19 11	11 0 9	5 18 3	15 17 6	1 5 5 6	19.16				
{ pipe drains	5 9	6 15	15 9	12 12 7	7 3 11	16 19 0	1 7 1 0	21.99				
c. Wheat.	5 11	6 15	15 9	13 5 3	7 13 9	15 17 6	1 7 1 0	25.60				
{ open ditches	5 1	3 9	9 6	7 4 0	2 2 8	16 19 0	1 1 9 2	4.95				
{ pipe drains	5 3	3 9	9 6	7 11 5	2 8 3	15 17 6	1 1 15 7	6.46				
d. Barley.	5 8	5 9	9 11	8 15 11	3 7 6	16 19 0	1 2 13 11	9.16				
e. Horse	5 10	5 9	9 11	8 19 11	3 9 6	15 17 6	1 2 16 10	10.32				
{ open ditches	5 10	5 9	9 11	8 19 11	3 9 6	15 17 6	1 2 16 10	10.32				
{ pipe drains	5 10	5 9	9 11	8 19 11	3 9 6	15 17 6	1 2 16 10	10.32				
f. Potatoes (open ditches)	8 1	6 11	18 0	14 3 12	9 16 19 0	13 6 29 9	1 1 19 3	6.66				
g. Mangolds (open ditches)	6 6	11 14	5 8	10 9 6	4 2 6	16 19 0	1 3 9 0	11.71				
h. Carrots (open ditches)	6 19	8 17	17 0	15 14 3	8 14 7	16 19 9	1 8 1 0	27.33				
5) Unsanded field crops									5	21 18 7		
a. Winter rye	5 5	0 8	0 3	6 8 3	1 3 3	16 13 1	9 11	4.51				
b. Horse beans	5 8	5 8	2 11	6 10 3	1 11 16	13 1	8 7	3.94				
c. Potatoes	8 1	6 10	14 3	1 0 7	16 13 1	13 3 10 19	4 7 3	3.33				

The results show that a fen farm when suitably drained and managed is profitable from the point of view of both private and public economy.

On the distribution of the area devoted to the different crops the general economic and market conditions have a great influence. Field crops always require a sufficient amount of labour for the suitable tilling of the fen soil.

The cultivation of unsanded fens is to be practised only when the excessive distance from the mineral soil does not allow the dressing to be applied at a reasonable cost.

Underground drainage by means of pipes or fascines is under all circumstances to be preferred to open ditches for permanent pastures and field crops and this all the more the higher the purchase price of the bare soil.

For sanded fen soils, wheat, rye, oats, barley, potatoes, beets, grasses, beans, rape and colza are to be considered as sure crops. Other pulse, as well as serradella and mixtures of pulse and cereals (with the exception of lupins) are not to be quite neglected, but they are less advantageous. Sugar beets are to be grown according to the results of local trial in each individual case. Clover can only be considered in connection with grass leys.

For unsanded fen land the most suitable crops are rye, mixtures of wheat and pulse, beans, potatoes, and Swedes; next come rape and colza; oats and barley must be considered as doubtful. Wheat and beets are in general to be avoided, and they can at most be considered on fens that have been warped.

The injury to fen crops by frost and pests must also be carefully examined with a view to finding the most suitable means of protection. There is, however, a certain compensation between the drawbacks of farming on fens, such as severe winter or spring frosts, various pests and the abundance of weeds, and the fact that fens are better ensured against the consequences of continued drought than the best deep higher soils.

In the droughty year 1911 the valuable loess soils gave miserable yields of hoed crops, clover and spring cereals, while the crops in the fens were not much inferior to the average. At Neu Hammerstein they yielded as follows:

	Lbs. per acre	
Winter rye	3 200 grain	6 000 straw
Horse beans.	2 750 "	7 300 "
Oats	3 900 "	5 600 "
Potatoes	40 900	
Mangolds	50 700	
Carrots	83 750	
Meadows	8 000	
Pastures	430 increase of live weight.	

849 — **The Cost of Establishing an Orchard.** — EVANS, L. A. — *The Cultivation of the Apple in Tasmania*. Hobart, 1914.

The following are the data on the cost of establishing two apple orchards, one 25 acres in extent and the other 100.

Twenty-five acre orchard.

	£
Twenty-five acres at £20 per acre (ready for the plough)	500
Fencing, packing-shed and cottage	350
Five thousand trees at 70s per 100	175
Planting 25 acres	15
Five years' cultivation, pruning, etc., at £4.10s per acre	560
Interest on outlay for five years at 5 per cent. compound interest.	370
Unforeseen expenses	30
Total	<u>£2000</u>

The returns from the fifth to the seventh year may fairly be calculated to pay the orchard expenses. From the tenth year onward the annual return from the orchard should be at least 6 000 bushels. These, at the moderate estimate of 2s 6d per bushel on the trees, give £750; deduct £225 for working (calculating at £9 per acre), leaving £525, from which the annual interest on £2000 has also to be deducted. Thus there would be a clear income of £425. It must not be forgotten that a *bona fide* settler gives his own work and would thus save £80 a year; in addition if he has £2000 capital he would get the interest on the amount invested, or an average of £74 per year, giving him £154 to live upon until the orchard came into bearing; further that the price of 2s 6d per bushel on the tree is a moderate price and that by careful attention to packing and good judgment in marketing higher prices can be realized.

The following estimate deals with a 100-acre orchard:

Estimate of cost of 100 acres of land cleared and planted with apples.

	£
First cost of 100 acres of land, at £5 per acre	500
Grubbing, etc., and clearing land to make it fit for ploughing, at £6 per acre	600
Cost of ploughing and subsoiling	100
Two-year-old apple trees at £3 per 100, planting 100 per acre	300
Cost of planting	100
Purchase of four farm horses	100
Implements and tools	300
Fencing with wire netting	80
Drainage	100
Cost of buildings for manager, workmen, stables, etc.	780
Manuring young trees, artificials	450
Horse feed and cost of keeping horses for one year £100, labour and management £824 per year for five years	4620
Total cost of 100 acres of orchard at the end of five years containing 7-year-old trees	<u>£8000</u>

AGRICULTURAL INDUSTRIES.

INDUSTRIES
DEPENDENT ON
PLANT
PRODUCTS

850 - Refrigeration and Aeration of New Wines as a Means of Hastening their Maturity. — KLOSS, J., and SCHNEIDER, F., in *Allgemeine Weinzeitung*, Year 31, No. 28, pp. 313-315. Vienna, July 9, 1914.

The writers carried out at the zymo-chemical laboratory of the College of vine and fruit growing at Klosterneuburg (Austria) several experiments on new white and red wines in order to study the effect of refrigeration followed by intense aeration on the maturing process. The wines, in bottles and in casks, were kept during 24 to 48 hours at temperatures of 28.4 to 26.6° F. (at which temperatures they did not freeze), after which they were aerated (by passing air through them for 24 hours or racking them off and allowing them to fall in a shower through air) and then stored in a cool cellar for a fortnight. They were then filtered and examined. The wine used as control was not refrigerated, but otherwise it was treated in the same way.

The results were as follows: In red wines no effect of refrigeration could be determined. In white wines, on the contrary, the colour was darker than in the control wine and the taste and fragrance had decidedly more of the character of old and ripe wines. Chemical analysis showed a marked decrease in the content of nitrogenous matter; such a decrease is produced only by keeping wine a long time in cellarage and racking it repeatedly. The processes of oxidation, which cause certain constituents of wine (especially those containing nitrogen) to become insoluble and consequently to precipitate, take place much more rapidly in refrigerated wines.

Another benefit derived from refrigeration and aerating was seen in that the wines so treated and then filtered kept perfectly clear, whereas the control wines very soon became turbid, which change is connected with the nitrogenous matter still contained in the wine.

INDUSTRIES
DEPENDENT ON
ANIMAL
PRODUCTS

851 - Development and Present Situation of Milk Recording and Book-keeping Associations in Denmark. — Prepared from a communication from A. C. DUBORG, *Aadviser, Rudkøbing*, Denmark.

According to a communication from the Danish Statistical Bureau, there were in 1909, 519 Record Associations in receipt of subventions from the State. Of this number 128 had been founded between 1895 and 1899, 207 between 1900 and 1904 and 184 between 1905 and 1909.

In 1909, 12 572 farmers possessing 224 837 cows were members of record associations, while 167 235 farmers with 1 047 316 did not belong to any association, and 2 566 farmers with 9 821 cows had not sent in any answer to the enquiry.

The following figures for the year 1909 show the connection between the size of the farms, the number of animals and milk recording:

Size of farm	Percentage of farms in which milk records are carried out	Percentage of cows under record out of total of country
up to 1.36 acres	0.3	0.5
from 1.36 to 12.26 "	1.1	1.4
» 12.26 » 36.80 "	3.3	4.7
» 36.80 » 73.60 "	11.2	14.8
» 73.60 » 147.20 "	18.9	24.5
» 147.20 » 588.82 "	21.1	34.4
Above 588.82 "	38.8	46.3
On the whole	7.2	18.0

It is thus evident that it is mostly the larger farms that submit their cattle to milk recording.

Many of the larger farms carry out milk recording by themselves and these are not included in the above figures.

The number of milk recording associations has been almost stationary since 1909; this is due to the fact that the greater part of farmers interested in cattle breeding, in so far as conditions allow, belong already to these associations.

In northern and western Jutland there are only a few record associations, as there fattening is prevalent. On the islands and in south-eastern Jutland about a quarter of the number of cows are under record, in Fünen a third.

By the union of the associations into federations a certain uniformity of method is attained. Milk recording has already exerted some influence on breeding. At cattle shows only bulls which can show controlled performance records of their dams, grandams, etc., are exhibited. In Fünen fairly high performances of the dams have been required as the lowest limits for admission to the shows.

The law of June 8, 1912, provides a yearly state subvention of £5 600 for these associations, each of which gets £11 on condition of conforming to certain regulations.

A record association has usually from 15 to 25 members with about 400 cows. The control work is carried out about every 20 days. The yearly cost per cow amounts to from 1s 5³/₄d to 1s 10¹/₂d per cow and without the State grant to 2s 2d; in these sums the board and lodging given by the members to the control assistant are not reckoned.

Of late years the tendency is towards entrusting the control assistants not only with the accounts immediately connected with the milk records but also with the whole book-keeping of the farm. Thus the record associations gradually become book-keeping associations. The beginnings of these associations were fairly simple but not uniform. In the year 1908 such a book-keeping association was founded at Langeland and it has been followed by others. The work of milk recording goes on in them as usual, only as the book-keeping associations are smaller, the records

can be made oftener, which is all to the advantage of the greater trustworthiness of the results. The farm accounts at the same time supply a certain check on the performance records. The number of members is, as a rule, from 15 to 18; they farm from 1 200 to 2 000 acres and own 200 to 300 head of cattle.

The cost of the book-keeping is reckoned on the basis of the acreage of the farm, while the cost of milk-recording is based on the number of head of cattle, as in the other record associations. A farm of 61 acres pays for its book-keeping from 22 to 33s a year. The farmers enter in specially prepared books and a cash book the several transactions according to the system of simple entry. When the record association assistant visits the farm, for the first time in every month, he posts the farmer's entries in the regular account books kept on the double entry system. This has the advantage that any error can be rectified at once *viva voce* and on the spot. According to the wish of each member the books are kept with a greater or lesser number of accounts. In general the farmers desire to know the returns of the various crops and the profitableness of the different branches of their farms.

852—Preserving Milk Samples for Examination. — TILLMANN, F., SPITZER, A., and RIFFART, H., in *Zeitschrift für Untersuchung der Nahrungs- und Genussmittel sowie der Gebrauchs-Gegenstände*, Vol. 27, Part 12, pp. 893-901. Münster i. W., June 15, 1914.

According to the writer's experiments the requirements of an ideal means of preservation are: 1) It must preserve the degree of acidity of the milk for at least 72 hours. 2) It must not bring about any change in the behaviour of the milk to alcohol. 3) It must cause no change in the physical and chemical composition of the milk. 4) It must not have any action on the nitrates which may be contained in the milk and especially a) it must preserve the nitric acid from decomposition, b) it must have no action on diphenylamine, neither weakening nor reinforcing its effect.

In view of these requirements the experiments made by the writers in their research for the most suitable substance, led to the discarding of a number of substances commonly used. They tried chloroform, thymol, oil of mustard, phenol, creosote, sodium fluoride, mercuric chloride, and potassium bichromate. The latter substance reacts strongly on diphenylamine and should have been discarded, but it was tested owing to its current use.

The examination of the above-named substances led to the following results:

Thymol, phenol, creosote and sodium fluoride cause the milk to coagulate after 24 to 48 hours. Bichromate of potash, owing to the intense yellow colour it gives to milk, does not allow an accurate determination of the degree of acidity to be carried out. Chloroform causes an increase of refraction and of fat content. Creosote causes a decrease of specific gravity. Thymol and creosote enfeeble the diphenylamine reaction to a considerable extent. This is also the case in a small degree with oil of mustard and phenol. Bichromate of potash causes milk to give a strong

positive reaction with diphenylamine, even without the addition of a nitrate. Of all the means of preserving milk only chloride of mercury answers to the above-mentioned requirements. When used in a 0.04 to 0.03 per cent solution it preserves milk quite fresh for 120 hours without any noticeable increase of acidity.

Further it has no action whatever upon the milk constants and allows the quantitative determination of nitrates to be carried out even after 120 hours. The use of chloride of mercury for official milk control is, however, owing to its poisonous nature, only admissible with certain precautions. Thus to allow it to be easily recognized the writers add Congo red to the sublimate. This colouring matter, used at the rate of 0.2 cc. of a 2 per cent. solution in water in 250 cc. of milk, has no effect at all upon the results of the analysis of the latter.

PLANT DISEASES

GENERAL INFORMATION.

LEGISLATIVE
AND ADMINI-
STRATIVE
MEASURES.

853 - Decree of the President of the French Republic, June 9, 1914, Authorizing the Introduction into France of Plants other than Vines through the Dijon Customs House. — *Journal officiel de la République française*, Year 44, No. 166, p. 5389. Paris, June 20, 1914.

Art. 1. — Trees, shrubs and all plants other than vines coming from foreign nurseries, gardens, hot-houses and orangeries may be introduced into France through the Dijon Customs House under the conditions set forth in articles 2 and 3 of the decree of August 28, 1882.

Nevertheless, the certificate of the competent authorities of the country of origin will not be required when the plants come from an establishment entered in the lists published according to article 9, paragraph 6, of the International Phylloxera Convention.

Art. 2. — The Ministers of Agriculture and of Finance are charged, in their respective spheres, with the carrying out of the present decree.

854 - Order of the French Minister for the Colonies, June 19, 1914, forbidding the Importation of Hevea Plants into Indo-China. — *Journal officiel de la République française*, Year 46, No. 170, p. 5488. Paris, June 24, 1914.

Art. 1. — The importation into Indo-China of hevea plants is forbidden; the introduction into the Colony of hevea seeds is allowed and is not subject to any disinfection.

Art. 2. — The Governor-general of Indo-China is charged with the execution of the present order.

855 - Order of the French Minister for the Colonies, June 19, 1914, Establishing Regulations Concerning Disease in Coconut Plantations in Cochin-China and in the Annam and Cambodia Protectorates. — *Journal officiel de la République française*, Year 46, No. 171, pp. 5534-5535. Paris, June 25, 1914.

Art. 1. — A regulation concerning disease in coconut plantations has been established on the following bases in the Colony of Cochin-China and in the Annam and Cambodia Protectorates.

Art. 2. — Any person, owner, manager, farmer or holder in any way of coconut plantations which have been attacked by the Coleoptera known as elephant beetle or black beetle (*Oryctes rhinoceros* L. ; in Annamese the perfect insect is called " con kien vuong " and its larva " con sung ") or those known as coconut weevil (*Rhynchophorus ferrugineus* Oliv. ; in Annamese the perfect insect is called " con hu xe ", its larva " con duong ") or by any other insect or in general by any disease of whatever nature, must immediately declare it to the nearest native or French authorities, who will without delay forward such declaration to the Chief Administrator of the Province, who, after having ordered a technical examination of the plantation, will order one of the following measures.

Art. 3. — If the trees are only slightly attacked by the elephant beetle, that is to say if only 5 or 6 holes bored by the insect have been found, the owner or other person in charge must have the holes stopped with a composition containing pitch, coal-tar or similar compounds, and must destroy throughout the property all the sources of infection as defined in art. 5 ; he must also carry out such other measures as may be ordered by the authorities, in particular those which will be set forth in the special instructions published by the Administration.

Art. 4. — If the trees are either dead, badly attacked by the elephant beetle, or simply attacked by the weevil, they must be uprooted and either entirely destroyed by fire or completely immersed in water so that the eggs, larvae, pupae or perfect insects be destroyed and that the débris may not become a breeding place or a refuge for new parasites.

Art. 5. — Any person possessing lands at a distance of less than 2 km. (1 $\frac{1}{4}$ mile) from a coconut plantation (that is an area planted with about 40 coconut palms per acre) is bound to destroy on the land belonging to him, the palms or other plants attacked by the elephant beetle or the weevil, to remove or destroy the dead plants, trunks or debris of coconut trees, and the heaps of manure or any other decomposing organic matter in which the presence of larvae of beetles has been detected or which may become sources of infection.

Art. 6. — The Chief Administrators of the provinces and their assistants, the Agents of the Agricultural and Commercial and Forest Services, or any officials appointed by the Government, are to have free access to the coconut plantations, whatever their extent, in order to ensure the observance of the present Order. They can draw up reports which will be conclusive in default of proof to the contrary.

Art. 7. — Any person refusing or neglecting to comply with the instructions contained in the above articles 1, 2 and 3 is subject to the penalties set forth in articles 479 and 482 of the Penal Code.

Art. 8. — The same judgment inflicting the above penalties may, in the cases contemplated by articles 4 and 6, order the destruction of the trees or sources of infection by the village and at the expense of the offender. If it is an European or a person considered as such, this destruction will be carried out in the same way but under the supervision of a police officer.

Art. 9. — The Governor-general of Indo-China is charged with the execution of the present Order.

856 — Italian Royal Decree of May 3, 1914 (No. 425), Instituting an Independent Phytopathological Observatory at Turin. — *Gazzetta Ufficiale del Re no d'Italia*, Year 1914, No. 130, pp. 3056-3057 Rome, June 10, 1914.

Art. 1. — An independent Phytopathological Observatory is founded at Turin on the initiative of the Agricultural Association (Comizio Agrario) of Turin; the expenses are defrayed by the Commune, the Savings Bank, the Chamber of Commerce, the Charitable Foundation of St. Paul, the Grand Masters of the Orders of Saints Maurice and Lazarus and of the Crown of Italy, and the Agricultural Association, with assistance from the State.

Art. 2. — The objects of the observatory are : a) to follow carefully any condition of disease in cultivated plants and to study its causes and remedies ; b) to spread among farmers, by means of meetings, talks and practical lessons to be given in various localities, a precise knowledge of the diseases of plants and of the best means of controlling them ; c) to start, with the cooperation of farmers, experiment fields for the protection of plants against the most widely spread diseases ; d) to watch over the public gardens and avenues of the city of Turin from the point of view of plant diseases and at the request of the Municipality, and if necessary to assist in the application of suitable means of control ; e) to examine doubtful mushrooms and other fungi at the request of the Bureau of Hygiene ; f) to give verbal or written consultations to the farmers of the district ; g) to attend to the institution of a special Museum of Plant Pathology ; h) to examine the seeds of cultivated plants as to purity and germination ; i) to undertake the services of vigilance, warning, prevention and cure of the diseases of plants in Piedmont.

Art. 3. — The observatory is managed by a Board of Administration composed of representatives nominated one each by the Ministry of Agriculture, the Turin Savings Bank, the Turin Agricultural Association, the Municipality of Turin, the Chamber of Commerce and Industry of Turin, the Charitable Foundation of St. Paul, the Grand Master of the Order of St. Maurice, and those bodies or private persons who contribute annual subscriptions of not less than £ 20. The members of the Board hold their seats for three years and may be re-elected. The Board elects from among its members a president, also for three years and eligible for re-election. The director of the observatory is a member of the Board and acts as secretary.

Art. 4. — The Director is at the head of the scientific activity of the Institute ; he must present every year to the Board of Administration a report upon the work done in the course of the year, the programme of the experiments to be carried out in the following year, the estimate of the expenses and the balance sheet of the preceding year, audited by an accountant who is elected every three years by the Board and who may assist at the Board meetings as advisory member. Every year a copy of

each of these documents will be sent to the Ministry of Agriculture, Industry and Commerce.

Art. 5. — Besides the Director, the staff of the Observatory includes an Assistant Director and a Curator-Secretary. The Assistant Director has the supervision of the Laboratory and, when necessary, replaces the Director. The Curator-Secretary is entrusted with the books, correspondence, library and collections, and if he has a degree he may substitute the Assistant-Director. If the budget allows, a second Assistant may be engaged according to the decision of the Board of Administration. The President, after consulting the Director, may nominate one or two special volunteer or honorary unpaid Assistants, who will have the right to frequent the Observatory and to make use of the scientific material according to rules laid down by the Director.

Art. 6. — The Director is nominated according to the results of a competition organized by the Board of Administration and his nomination must be approved by the Ministry of Agriculture. The rest of the staff is nominated by the Board of Administration on the proposal of the Director.

Art. 7. — The funds of the Observatory are provided as follows: the State contributes £80 under chap. 66 of the Budget of the Ministry of Agriculture, Industry and Commerce for the year 1913-14, and in the corresponding chapters for the succeeding years; the Municipality of Turin £ 20; the Turin Savings Bank £ 80; the Chamber of Commerce of Turin £ 20; the Grand Master of the Order of Saint Maurice £ 20; the Charitable Foundation of St. Paul £20; the Agricultural Association of Turin £ 10. The Commune, besides its pecuniary assistance, provides housing, water, gas, stationery and plant other than scientific (furniture, etc.). The Ministry of Agriculture will also, in virtue of the Law of June 26, 1913 (No. 888), which deals with measures for the prevention and cure of the diseases of plants (1), furnish special funds for the services of vigilance, reporting, prevention and treatment of diseases of plants in Piedmont.

Art. 8. — The advice given to farmers is free of charge. The Board of Administration may however establish a tariff for the reports and other work demanded by the public.

Art. 9. — Other local institutions may give their adhesion to the present Statute, lending their aid to the Observatory and securing representation on the Board by agreement with the founders and with the approval of the Ministry of Agriculture, Industry and Commerce.

Art. 10. — Special regulations proposed by the Board and approved by the Ministry of Agriculture will regulate the working of the Observatory.

Temporary provision.

Art. 11. — The present staff (Director and Assistant Director) of the District Observatory (2) will continue its work in the Independent Phytopathological Observatory.

(1) See No. 995, *B.* Aug. 1913.

(2) See No. 278, *B.* Jan. 1911 and pp. 1000-1005, *B.* July 1913.

(Ed.)

BACTERIAL AND FUNGOID DISEASES.

GENERALITIES

857 — The Conditions determining the Outbreak of Vine Mildew in Hungary (1).

— Communicated by Dr. GY. VON ISTVANFFI, Professor at the University and Director of the Royal Hungarian Central Ampelological Institute, Budapest.

The Royal Hungarian Central Ampelological Institute of Budapest has now published (in Magyar) the fifth volume of its works; this contains the studies made by Dr. F. SÁVOLY under the direction of Dr. GY. VON ISTVANFFI. An abstract has also been published in French, as Vol. V of the *Annals* of the Institute; this was prepared on the occasion of the International Congress of Viticulture held at Lyons from July 20 to 22, 1914.

The most important results of Dr. Sávoly's work may be summarized as follows:

I. — The climatic conditions required by mildew cannot be determined except by carrying on researches for several years on an extensive and varied territory and by methodically working up the data thus obtained.

II. — Only study of the weather before the first appearance of mildew can lead to satisfactory results. It is sufficient to consider the temperature and the quantity and frequency of the rain. As unit of territory, the district ("járás") has been taken. The dates of the first appearance of the disease were noted on a map and the parts in which it appeared simultaneously were joined up by lines. The curves so obtained are called "isophanes" and the areas enclosed between them "isophanic belts". Starting from the first appearance of mildew and proceeding to the relatively late appearances, we distinguish a series of isophanic belts, each member of which corresponds to a period 1.55 times as long as the preceding one.

III. — Comparing the data obtained from 1910 to 1912 the following observations can be made: 1) The earliest appearance of mildew in Hungary was on May 21. 2) In general most of the dates of appearance were between June 5 and 15, that is to say during the flowering-period of the vines. 3) The date of the infection which causes this general outbreak of the disease must be sought in the last ten days of May.

IV. — The comparison of the mildew maps of the last four years gives the following results: 1) The first appearance of mildew occurs in the same locality every year, and its spread almost always follows the same main routes. 2) This characteristic constancy does not depend so much upon the weather as upon orographic causes and those connected with the nature of the soil. 3) In its spread mildew does not make jumps, but proceeds gradually from one locality to another; starting from the point at which it first appeared, numerous transition points are found towards the spots in which it appeared later. 4) The speed at which mildew spreads is not the

(1) See also No. 68, *B.* Jan. 1913; No. 1208, *B.* Oct. 1913; and No. 529, *B.* June 1914.
(Ed.)

same in all directions, but the speed in the several directions seems to be constant every year.

V. — The features more or less common to these four years are very visible on the map representing the appearance of mildew in its general outlines. It is seen, also: 1) That in general mildew starts from a triangular area the vertices of which lie near Kaposvár, Villány and Kécskemét. 2) That the disease advances for a certain time approximately in the directions marked by the angles of this triangle. 3) Independently of this first area, and one or two isophanes later, secondary centres of infection are observed, especially in the Kis-Alföld (Small Hungaria Plain), then near Versec and on the sands of Hajdu and Szabolcs counties. The last-named is the most important, as it is the point of departure of an independent invasion.

VI. — Mildew generally makes its appearance in the following order: first in the country to the north of the Mecsek mountain, between Kécskemét and Lake Balaton, and in the valley of the Danube towards Mohács; a little later on the plain in the angle between the Danube and the Drava and the northern part of the sandy land in Pest county; next follow the country about Versec and Fehértemplom and the sandy region of Hajdu and Szabolcs counties, which are separated from the central part of the Great Plain by a belt in which the disease appears late. After these two sandy regions comes the Kis-Alföld.

VII. — Mildew appears relatively late on the alluvial soils of the left bank of the Tisza, and along the Bodrog and the Maros and especially in the parts watered by the three branches of the Körös and the Berettyó, as well as on both banks of the Tisza (in Szolnok and Heves counties) from Szolnok as far as Tokaj; the same is the case in Torontál and Temes counties, in the valleys of the Temes and of the Bega, and in the southern parts of Bács county; the orographic and climatic conditions of these localities differ very little from those of the districts in which mildew appears early. This delay is rather due to the lack of great extents of sandy soil and the presence of large areas on which water stands.

VIII. — The disease appears latest, about 60 or 80 days after the first appearance in Hungary, in the western, southern, north-eastern and south-eastern parts of vine-growing Hungary situated at heights above 200 m. (660 ft.) and lastly in the eastern parts (Transylvania).

IX. — It appears from the study of the climatic data that the temperature of the month of April has a determining influence on the appearance of mildew. Provided there is enough moisture in winter and spring, which is almost always the case, mildew appears the earlier the more regular the rise of temperature in April. If in the month of April or at least in its second half night frosts have ceased (even though the warmth during the day may not be considerable), the appearance of mildew may be expected about the middle of May. But if there are repeated relapses in the rise of temperature in April the appearance of mildew will be retarded. This retardation will be all the greater the more frequent the relapses have been

and the longer they have lasted. In this case the appearance of mildew may be retarded to the end of May.

X. — The account of the weather before the first appearance of mildew has been kept as follows. A determination was made for each locality and then for the whole of the country situated within the same isophanes of the amount and frequency of the rainfall and the mean daily temperatures from April 1. By multiplying these three data by the number of days after April 1, a figure has been obtained in which the climatic factors appear in proportion to their biological value.

These biological values of the weather seem to show that in general mildew makes its appearance in a district when the biological value of the weather reaches the figure that it had in the first isophane of the year. The great deviations that the biological values of the different years present may be eliminated by introducing into the calculations a factor connected with the value of the position of the rain. (1) The biological value thus obtained for 1910 to 1913 is 281 ± 14 .

The writers call this figure "Bios". It expresses the value given by the weather calculated according to the above formula, when the meteorological conditions for the first appearance of mildew have been realized. Expressed in a mathematical formula: — $B = c.g.h.k.T$, in which B = Bios, c = the mean rainfall from the first of April to the day of the first appearance of mildew, g = the average of its frequency, h = the mean daily temperatures, k = the influence of the date at which the rain fell, T = the number of days of the period.

The regular decrease noticed in the table of the "Bios" values may serve as a kind of forecast. It is assumed that after the first isophane there will be no greater irregularities in the weather than in the period between the 1st of April and the first isophane. The deductions are made according to the rule of three, using the "Bios" of the first isophane and the "Bios" of the isophane in question. A series of numbers in inverse ratio to the series of decreasing "Bios" values is thus obtained.

Carrying out this calculation for the years 1910 to 1913 the following numbers of days are obtained :

Isophane	II	III	IV	V	VI	VII
1910	51	55	63	69	83	90
	51	56	63	74	91	117
1911	47	57	65	73	80	91
	47	52	59	70	87	113
1912	56	60	63	65	71	86
	61	66	73	84	101	127
1913	55	66	65	79	80	81
	53	58	65	76	93	119

The figures in heavy type show the date on which mildew was calculated to appear, those in ordinary type the actual date of appearance.

(1) This refers to the fact that rains of equal amount are more effective when they fall nearer to the date of appearance.

It will be seen that the two sets of figures show very considerable agreement.

The prognostic value of these series is undoubted, but their application is limited by the delay of three days necessary in calculating from the first isophane.

But the formula $B = c.g.h.k.T$ renders one independent of the first isophane; it has only to be borne in mind, according to the process described in the original work and for a great number of localities situated as regularly as possible, when the "Bios" attain towards the middle of May the value of $281 + 14$. It is in such localities that the appearance of mildew may be expected shortly; in this forecast use may advantageously be made of the temperature curve of the month of April and of the knowledge of ecological factors. One of the chief conditions of success of this method is a network of meteorological stations in perfect working order and with telegraphic connection.

XI. — According to these researches the districts in which mildew makes its first appearance in Hungary are determined by orographic and climatic conditions and especially by the nature of the soil and the conditions of superficial hydrography. The weather only influences the date of appearance. The disease does not appear first in the warmest districts and where most rain falls, but in the southern part of the Great Hungarian Plain where there are extensive sandy areas and a number of tracts liable to flooding. On the other hand the disease appears late, even in the southern districts, on cold soils, notwithstanding the abundance of superficial water and favourable weather. After an April with regular temperature and without white frosts the first appearance of mildew may be expected about the middle of May, and in general when the value of the "Bios" calculated from the 1st of April reaches the figure of 281.

858 — Results of Investigations made in Austria in 1913 into the Leaf-curl of Potatoes (1). — KÖCK, G., KORNAUTH, K., and BRJZ, O., in *Zeitschrift für das landwirtschaftliche Versuchswesen in Oesterreich*, Year XVII, Part 5, pp. 270-300. Vienna, 1914.

During 1913 the writers continued in several parts of Austria the research work which had been commenced on a large scale several years ago. Among other investigations they carried out a whole series of infection experiments with different species of *Fusarium* on several varieties of potatoes by simply surrounding the root crown of the plants with infected soil.

The most important conclusions that have been drawn from these and from the preceding investigations are the following:

1). Leaf-curl is a fungoid disease caused by forms of *Fusarium* or *Verticillium*; the former are predominant towards the south (for instance in Austria-Hungary), the others towards the north (northern Germany).

2). The primary infection (that is that of a plant that till then had

(1) See also No. 580, *B.* June 1914; No. 683, *B.* July 1914.

(Ed.).

been healthy and had sprung from a healthy plant) is caused by soil containing the above disease-producing agents.

3). The tubers obtained from a plant attacked by leaf-curl are not all necessarily diseased; some shoots may be quite immune and will naturally produce sound tubers; tubers formed on the shoots infected by the fungus are in some cases more or less infected by the mycelium of the parasite, or when the mycelium remains restricted to the vascular bundles of the haulm and the stolon, such tubers appear singularly weakened by the injurious action of the mycelium on the movements of the sap.

4). When tubers infected by the mycelium are planted, one of the two following circumstances is observed: either the mycelium grows (and this is rather rare) in the young shoots in course of formation — and the result is what the writers call “secondary infection”, with a new appearance of curled leaves, — or (as is the case with tubers not containing mycelium but weakened) sickly and weak plants are produced but without leaf-curl; the writers give this the name of “Folgekrankheit” (after-effect of the disease).

5). Leaf-curl and its after-effects may be spread by tubers produced by shoots which had suffered from primary infection (deriving from the soil).

6). Different varieties of potatoes possess a very different resistance to the disease; it seems as if none were completely immune.

7). For the control of the disease the following measures are recommended: *a*) to abstain from growing potatoes for at least five years in those fields in which leaf-curl has appeared; *b*) to select seed potatoes with the greatest care, to grow only varieties which have proved suitable to the locality and to choose a favourable soil; *c*) to strengthen the plants by appropriate manuring; *d*) to pick out carefully and remove from the growing crop any infected plants.

BACTERIAL
AND FUNGOID
DISEASES OF
VARIOUS CROPS

859 — A Disease Affecting the Sisal Hemp Plant: *Colletotrichum Agaves*

Cav. (1). — BANCROFT, C. K., in *The Journal of the Board of Agriculture of British Guiana*, Vol. VII, No. 4, pp. 181-182. Demerara, April 1914.

The leaves of sisal hemp (*Agave rigida* var. *Sisalana*) grown in British Guiana have during the past five years been affected by a disease which renders them useless for the preparation of the fibre, and which is due, according to laboratory observations, to *Colletotrichum Agaves* Cav.

As far as is at present known the parasite has appeared only on plants grown away from the coast, but the plant has not been cultivated near the coast to any great extent.

The fungus has been grown on artificial media. Inoculations on the cut surfaces of leaves (incisions, wounds, etc.) have confirmed the observations of Shaw on the reproduction of the disease and on the pathogenic agent. Attempts to reproduce the disease by placing the fungus on uninjured surfaces of the leaves have failed, thus again confirming the con-

clusion that the organism is a wound parasite, *i.e.* can only affect the leaf originally at a broken surface.

860 - **The "New Disease" or "Dry Disease" of the Sugarcane: *Marasmius Sacchari*.** — BANCROFT, C. K., in *The Journal of the Board of Agriculture of British Guiana*, Vol. VII, No. 4, pp. 183-187. Demerara, April 1914.

The writer describes under the name of "new disease" or "dry disease" the disease caused on the sugarcane by the fungus already known under the name of *Marasmius Sacchari*. The disease was first observed in British Guiana at Berbice in 1907; it has subsequently been reported to occur on many estates in different parts of the Colony. On some of these it has extended greatly, while on others it does not appear to have progressed rapidly and in some few cases it has disappeared after a short time.

The writer reports upon the methods employed in combating the disease. The varieties which are generally badly affected in this Colony are Bourbon, D 625, B 208 and Green Transparent. The two former suffer more than any other varieties. D 109 is also frequently affected; D 145 and D 118 are more resistant, while D 216 and D 159 are not reported to be affected.

The planting of the more resistant varieties in badly affected fields for a period of several years for the purpose of checking the spread of the disease is a matter which should receive careful consideration, as well as replacing infected stools with plants of more resistant varieties. The object of these methods would be to reduce the fungus in the soil to a minimum before replanting with the more susceptible varieties.

861 - **Two New Species of Fungi in Tobacco Seeds Beds: *Gloeopeziza turricula* and *Hyalopus geophilus*.** — SACCARDO, P. A., and PEYRONEL, B., in *Bollettino tecnico della coltivazione dei tabacchi*, pubblicato per cura del R. Istituto sperimentale in Scafati (Salerno), Year XIII, No. 1, pp. 3-6, 1 plate. Scafati, 1911.

The writers received from the Royal Experiment Institute for the Cultivation of Tobacco at Scafati two samples of mould from tobacco seedbeds, attacked by two species of fungi which they consider new to science and which they describe under the names of *Gloeopeziza turricula* and *Hyalopus geophilus*.

The former is a discomycete characterized chiefly by its ascophores, which are cylindrical or shaped like elongated truncated cones resembling little towers (whence the specific name); it is visible as brick-red dots on the mould, and, according to the information collected by the writers, it appears generally in January and February on the seedbeds formed of mould, which have previously been warmed and are protected by coverings. It develops in patches, frequently large, and forms a kind of red crust that hinders the development of the germinating tobacco seeds and often kills them. The species is allied to *G. Rehmii* Zuk. and *G. Zukalii* Rehm, from which it is easily distinguished by certain morphological characters. In another sample of mould received later the writers recognized *G. turricula* in a very young stage of development; this material allowed of preliminary observations on the sexual organs (carpogonia

and antheridia) contained in the young ascophores, which are then completely red.

Hyalopus geophilus (Mucedineae) is very minute and completely hyaline, so that it is difficult to distinguish it without the help of the microscope; this fungus develops on the same places as *G. turricula*, over which it spreads.

These two species do not live on moulds that have been carefully heated to about 100° C. (212° F.) for a couple of hours. Such partial sterilization is therefore recommended for the prevention of these fungi, as well as of parasitic diseases, weeds, etc.

862 - *Cladochytrium Mauryi* and *C. Ollivieri*, New Phycomyceetes on the leaves of *Colchicum autumnale* and of *Orchis incarnata* and *O. laxiflora* in France. — HAKIOT, P., in *Comptes rendus hebdomadaires des séances de l'Académie des Sciences*, 1914, 1st H II-year, Vol. 158, No. 23, pp. 1705-1707. Par'is, 1914.

The writer describes (with Latin diagnosis) two new species of *Cladochytrium*. One, *C. Mauryi*, was found in May 1914 on leaves of *Colchicum autumnale* at Châlons-sur-Marne; it seems to differ from all the other species that have been described as parasites of Liliaceae and Irideae. The other, *C. Ollivieri*, was found in May and June of the same year on leaves of *Orchis incarnata* and *O. laxiflora* at Esbly (Seine-et-Marne).

C. Ollivieri is very near *C. Mauryi*, but can be distinguished by the spots it forms being darker, longer and smoother; its spores also seem larger.

Orchis laxiflora appears to be only exceptionally attacked, and the spots upon it seem smaller and more scattered and never run together to occupy the whole area of the leaf. At Esbly plants of *Colchicum* growing in abundance among the orchises are never attacked; at Châlons-sur-Marne on the contrary the orchises are never attacked.

The leaves of *Orchis* on which *C. Ollivieri* is growing are frequently infected by the acidium stage of *Puccinia Orchidearum-Phalaridis* Klebahn.

Perhaps the two species of *Cladochytrium* are only biological species and resemble in this the rusts of the group of *Puccinia graminis* and *P. Rubigo-vera*, and the species of *Peridermium*.

INSECT PESTS.

GENERALITIES

863 - Occurrence of the Colorado Beetle (*Leptinotarsa decemlineata*) in Germany (1). — *Illustrierte landwirtschaftliche Zeitung*, Year 34, No. 57, pp. 538-539, 1 fig. Berlin, 1914.

The presence of the Colorado potato beetle (*Leptinotarsa decemlineata*), which had not been seen in Germany since 1887, has been reported from Hohenwedel near Stade (Hanover); the Government immediately ordered the most drastic measures against this dangerous beetle.

(1) See also Nos. 2295 and 2360, *B. July 1911*.

(Ed.).

864 - *Micrococcus nigrofaciens* as Cause of an Infectious Disease of the Larvae of *Lachnosterna* spp. in the United States and in Portorico: — NORTHRUP ZAE in *Centralblatt für Bakteriologie, Parasitenkunde u. Infektionskrankheiten*, Part II, Vol. 41, No. 11-17, pp. 321-330, figs. 1-5, plates I-IV. Jena, 1914.

During the summer of 1912 specially severe injury to various crops due to the white grubs of May or June beetles (*Lachnosterna* spp., *Scarabaeidae*) were reported from Michigan.

The appearance of these beetle larvae was accompanied by the manifestation of a bacterial disease characterized by the blackening of the parts of their bodies affected. The cause of the infection is a species of *Micrococcus*, for the above reason named *M. nigrofaciens*. It was found under the microscope in almost pure culture on agar plates inoculated from the diseased part of a live larva. It is frequently associated with a gas-producing bacillus (*Bacillus septicus insectorum* of Krassiltschik ?), from which it is separated with difficulty.

The *Micrococcus* lives in the soil and is present in many soils of Michigan, Illinois, Maryland, Northern Carolina, Portorico and very probably in other countries also. It grows well on the usual nutritive media, but much better on the special media prepared with the larvae (gelatine, agar, broth) and on the larvae themselves. It colours well with the usual water and alcohol colours, and shows clearly the process of division; it is Gram-positive but not acid-fast.

The disease has been successfully reproduced in a healthy larva of *Lachnosterna* by placing it on artificially infected soil and incising its integument.

The characteristic alteration was also caused in some healthy larvae of another beetle, *Allorhina nitida*, by placing them on soil soaked with water and sterilized, to which some broth containing the *Micrococcus* in suspension was added. It seems as if in the individual larvae of the same genus the power of resistance to the *Micrococcus* varies greatly. The youngest seem to be the most susceptible; the larvae of *Lachnosterna* seem less resistant than those of *Allorhina*.

The micro-organism in question proved pathogenic to adults of *Periplaneta americana*; the disease followed its course as in the larvae of *Lachnosterna*; nevertheless the infection was apparently limited to the legs.

It has not been possible to determine whether the *Micrococcus* is pathogenic for earthworms, nor have repeated attempts to isolate it from the naturally infected soil succeeded.

Excessively moist soil favours the progress of the disease and this may be considered one of the chief factors in rendering the infection mortal.

In the soil there exist other organisms which may produce an infection in the larvae. The above-mentioned gas-producing bacillus found in the culture plates appears in determined conditions to contribute to render the disease mortal and it may be the first micro-organism to invade the insect.

The *Micrococcus* does not lose its virulence after having been cultivated artificially for upwards of a year.

It has not yet been possible to try this micro-organism as a remedy in the control of the larvae of *Lachnosterna*; this will, however, be done as soon as possible. The larvae of some *Lachnosterna*, commonly called "caculo" or "gusano blanco" at Portorico, are there very injurious to sugarcane: in order to experiment the *Micrococcus* against them, cultures have been sent to Rio Piedras and Mayaguez; no definite results have been obtained.

From the conclusive results obtained by inoculating and saturating the soil, the inference may be drawn that the *Micrococcus* may in the future be usefully employed in the control of the larvae of *Lachnosterna*, especially in conjunction with other parasitic diseases to which the larvae are subject. Since this micro-organism has also the power of infecting the larvae of another genus (*Allorhina nilida*) and also adult insects (*Periplaneta americana*), it seems to suggest the possibility of extending its use, applying it especially in the control of other injurious larvae in the soil.

INSECTS
INJURIOUS
TO VARIOUS
CROPS

865 - The Grass Moth (*Remigia repanda*), a Pest of Sugarcane, Rice and Paragrass in British Guiana (1). — BODKIN, G. E., in *The Journal of the Board of Agriculture of British Guiana*, Vol. VII, No. 4, pp. 171-177. Demerara, April 1914.

Remigia repanda is a member of the family Noctuidae; owing to its habit of living on numerous grasses, and particularly paragrass (*Panicum muticum*) it has been given the popular name of Grass Moth. In British Guiana it has been a well-known pest for many years, though this is the first account of its life-history published in the Colony.

On sugarcane, rice — with the rice caterpillar (*Laphygma frugiperda*) — paragrass and other grasses throughout the coastlands this moth may be found all the year round, and at certain periods, particularly on the occurrence of rain after prolonged drought, the larvae appear in vast hordes completely destroying whole areas of the above crops. It also occurs in several of the interior districts.

In Trinidad it has recently occurred as a serious pest and it is also known as a pest in Jamaica. The following are the localities whence *R. repanda* has been recorded: Canada, Labrador, United States (Texas, Florida), Mexico, Honduras, Costa Rica, Panama, Colombia, Venezuela, Guiana, Brazil, Argentina, Antilles (Cuba, where it has been recorded on *Hypericum*, San Domingo, Jamaica and Martinique).

Under normal conditions this insect is not responsible for any serious damage and may easily be controlled.

The various instars of the life-history of this insect in the Colony coincide with those which have been described by Dr. Dyar of the United States; his description is appended by the writer. The ova have never been observed on the food-plants in this colony. The complete life-cycle occupies under normal circumstances from 26 to 31 days.

No actual parasites have so far been secured from this insect in Bri-

(1) See also No. 803, B. Aug. 1914.

tish Guiana. The Coccinellid beetle *Megilla maculata* De Geer frequently preys on the young larvae, and the so-called Demerara Robin (*Leistes guianensis*) will also feed on them.

On sugar estates the usual method employed when a slight attack of this pest occurs is to pick them off the canes by hand and drop them into buckets containing kerosene and water. When efficiently carried out this is an effective measure, but the application of dry powdered arsenate of lead would give just as satisfactory results and would prove cheaper.

When it attacks rice in the nursery beds, flooding may be resorted to, as described for the control of the rice caterpillar.

As regards paragrass, the value of the crop hardly guarantees the application of control measures; a field when badly attacked may be left till the caterpillars enter the chrysalis stage and then burnt off to prevent further infestation.

866 - A New Sugarcane Aphis (*Aphis bituberculata*) in Louisiana. — WILSON, H. F., in *Entomological News*. Vol. XXV, No. 7, pp. 298-299, plate XIII. Philadelphia, 1914.

The writer received in 1912 some specimens of an aphis which had been found on *Saccharum officinarum* in Louisiana (Audubon Park, New Orleans). Not having been able to identify it with any other aphis found on sugarcane, he describes it as new to science under the name of *Aphis bituberculata*.

867 - Eelworms Injuring Hops in Bavaria. — WAGNER in *Praktische Blätter für Pflanzenschutz*, Year XII, Part 6, pp. 66-68, 1 fig. Stuttgart, 1914.

In August 1913 the writer observed at Pörnbach in a well cultivated seven-year-old hop garden a few dozen plants near each other which presented a very stunted growth. The hops were quite withered and worthless.

It has been ascertained that the mischief was due to the presence of eelworms—very probably *Tylenchus devastatrix* Kühn—on the rootlets. Eelworms had not previously been observed at Pörnbach, even on other crops.

868 - *Godara comalis*, a Cabbage Moth, Attacking Turnips in Queensland. — JARVIS, E., in *The Queensland Agricultural Journal*, New Series, Vol. I, Part 6, pp. 427-429, plate 62. Brisbane, 1914.

One of the least known cabbage moths, *Godara comalis*, has recently manifested a decided liking for turnips, the caterpillars feeding freely on the leaves so as to leave only the skeleton.

This species is sometimes found in association with *Hellula undalis*, a notorious pest known as the cabbage webworm, which not only causes serious damage to this vegetable, but is destructive at times to turnips and other cultivated Crucifers.

With reference to control, prompt measures at the commencement of the season are of the utmost importance, since destruction of the first brood of moths will materially decrease the injurious action of succeeding generations. Arsenical sprays are of little use against larvae well established

among the heart leaves of big cabbages, but should be effectively applied to young plants or to the foliage of turnips.

The writer does not believe that this pest has hitherto been recorded as attacking cabbage seed-beds, but if it should do so Bordeaux mixture sprayed upon seedlings whilst in the bed and when planted out should act as a deterrent.

It is advisable to destroy carefully all weeds, especially of Cruciferous plants, and any badly injured cabbages, and never to allow stumps with worthless leaves to remain in the field after the crop has been removed. Such refuse should be put in a heap and burnt without delay. Cultivating between cabbages at a time when the larvae are in the pupal stage would doubtless destroy many of them, and also improve the general condition of both crop and soil.

869 - The Rose Beetle (*Adoretus vestitus*) and the Injury it Causes in the Samoan Islands. — FRIEDERICH, E., in *Zeitschrift für wissenschaftliche Insektenbiologie*, Vol. X, Part 2, pp. 41-47, figs. 1-6, Berlin-Schöneberg, 1914.

The writer gives a minute description of the larva, pupa and imago of *Adoretus vestitus* Boh., which is very abundant in the island of Upolu, where it is called "Rosenkäfer" by the German colonists, as the perfect insect attacks by preference rose leaves, which it riddles completely. The rose plants are often quite despoiled of their leaves and killed. The insect feeds also on larger leaves such as those of cacao, and in a characteristic manner, leaving only the outer edges and the ribs untouched. The writer recently observed many young cacao plants in a plantation destroyed by *Adoretus*. Even large trees were seriously injured by these insects. Other frequent host plants are *Coffea liberica*, *Hibiscus tiliaceus* ("fau" of the Samoans; almost every plant has its leaves completely devoured), *Terminalia litoralis* ("talie" of the natives) and others.

The injury caused by these beetles, with the exception of that to roses (which have no economic importance in Samoa), has not hitherto been very severe; the insect and the mischief that it does are, however, on the increase and perhaps before long it may become dangerous.

The eggs of *Adoretus* are unknown to the writer. The larvae when fully developed are about eight-tenths of an inch in length; they are of a yellowish white and are found at all times and of all sizes on the roots of Gramineae and under rotting vegetable matter, especially in decomposing farmyard manure, from which it may be inferred that the insect multiplies all the year round. Before pupating, the larvae rest for a long time; then they prepare, by means of a special secretion, a kind of cocoon of earth which protects them from their enemies. The larvae do not injure the roots of plants. Probably the insect has been introduced into the Samoan Islands (where it was first noticed about six years ago) in the larval stage by means of vegetable matter surrounded by earth. The adult insect is from 0.4 to 0.5 in. long; its colour varies from yellowish to a brownish red. It lies hidden during the day and is therefore very rarely found; it feeds and mates at night. If disturbed it allows itself to fall from the leaves. It appears in great numbers throughout the year.

It has been observed that it is always the small cacao trees not sheltered in any way which are killed by the insect, while those in the shade of other trees or surrounded by bananas, for instance, often remain uninjured. Roses have been protected by mosquito curtains being thrown over them at night and cacao nurseries might be equally protected by old fishing nets. Shaking the plants and collecting the adult insects has given only partial results, as new individuals keep on appearing. Spraying with various substances has prevented the beetle from devouring the leaves, but these have been damaged by the remedies used. Insectivorous birds or mammals ought to be introduced into Samoa to feed upon the larvae in the soil. Hitherto the attempts to infect *Adoretus* with the green muscardine fungus (*Metarrhizium Anisopliae*), which has been recently used in Samoa with very promising results against the larvae of *Oryctes rhinoceros*, the worst enemy of cacao, have failed. The writer will continue his researches in this direction.

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FIRST PART.
ORIGINAL ARTICLES

The Present Status of the Cattle Industry in Canada

by

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According to the last Dominion Census held in 1911, there were in Canada at that time 6 533 436 cattle. The following table indicates how these are distributed by provinces as well as the comparative increase which has taken place during the last 40 years.

An examination of the above statistics, while making clear that there has been a regular and reasonable increase during the past fifty years in the cattle population of the country, reveals a somewhat anomalous situation as regards the proportionate development of the Eastern and Western areas of the Dominion. In Eastern Canada, production has barely held its own and particularly in the provinces of New Brunswick and Nova Scotia there has been a distinct falling off during the past two decades. On the other hand, Western Canada, including the prairie provinces and British Columbia, has made definite and satisfactory advancement.

The conditions causing this situation are not far to seek. The lure of free land has turned the tide of settlement westward, the movement of emigration being not only from across the Atlantic but as well from the rural districts of the Maritime provinces, Quebec and Ontario. The redistribution of population, following the opening for settlement of the extensive and fertile areas in the provinces west of the Great Lakes has had a very important bearing upon the development of the live stock industry.

A further feature, pertaining to the relative growth of urban and rural populations, should also be alluded to in this same connection. There has been, during the past ten years, in every province of Eastern Canada, with the exception of Quebec, a decrease in the rural population, while,

	1871	1881	1891	1901	1911
<i>Prince Edward Island.</i>					
Milch Cows	—	45 895	45 849	56 437	52 109
Other Cattle	—	44 827	45 846	56 342	68 287
Totals	—	90 722	91 695	112 779	120 396
<i>Nova Scotia.</i>					
Milch Cows	122 688	137 639	141 684	138 817	129 302
Other Cattle	151 279	187 964	183 088	177 357	158 122
Totals	273 967	325 603	324 772	316 174	287 424
<i>New Brunswick.</i>					
Milch Cows	83 220	103 965	106 649	111 084	108 532
Other Cattle	80 467	108 595	98 043	116 112	113 659
Totals	163 687	212 560	204 692	227 196	222 191
<i>Quebec.</i>					
Milch Cows	406 542	490 977	549 544	767 825	753 134
Other Cattle	376 920	539 356	419 768	598 044	697 860
Totals	783 462	1 030 333	969 312	1 365 869	1 450 994
<i>Ontario.</i>					
Milch Cows	638 759	782 245	876 167	1 065 763	1 032 979
Other Cattle	764 415	919 924	1 064 506	1 422 043	1 471 694
Totals	1 403 174	1 702 167	1 940 673	2 487 806	2 504 673
<i>Manitoba.</i>					
Milch Cows	—	20 355	82 712	141 481	155 337
Other Cattle	—	39 926	147 984	208 405	279 776
Totals	—	60 281	230 696	349 886	435 113
<i>Saskatchewan.</i>					
Milch Cows	—	—	—	—	181 146
Other Cattle	—	—	—	—	452 466
Totals	—	—	—	—	633 612
<i>North-West Territory.</i>					
Milch Cows	—	3 848	37 003	56 634	—
Other Cattle	—	9 024	194 824	212 145	—
Totals	—	12 872	231 827	268 779	—
<i>Alberta.</i>					
Milch Cows	—	—	—	46 101	147 687
Other Cattle	—	—	—	276 859	592 163
Totals	—	—	—	322 960	739 850
<i>British Columbia.</i>					
Milch Cows	—	10 878	17 504	24 535	33 953
Other Cattle	—	69 573	109 415	100 467	105 230
Totals	—	80 451	126 919	125 002	139 183
<i>Dominion of Canada.</i>					
Milch Cows	1 251 209	1 595 800	1 857 112	2 408 677	2 594 179
Other Cattle	1 373 081	1 919 189	2 263 474	3 167 774	3 930 257
Totals	2 624 290	3 514 989	4 120 586	5 576 451	6 533 436

for the same period, there has been a significant increase in the urban population. In Western Canada, however, there has been an increase of population in both rural and urban districts. The following table will be of considerable interest in making clear this comparison.

Rural and Urban population of Canada in 1911 and 1901 by Provinces and the Increase in the decade.

Provinces	Population 1911		Population 1901		Increase	
	Rural	Urban	Rural	Urban	Rural	Urban
Dominion total . .	3 925 502	3 281 141	3 349 516	2 021 799	+ 575 986	+ 1 259 342
Alberta	232 726	141 937	52 399	20 623	+ 180 327	+ 121 314
British Columbia .	188 796	203 684	88 478	90 179	+ 100 318	+ 113 505
Manitoba	255 249	200 365	184 738	70 473	+ 70 511	+ 129 892
New Brunswick . .	252 342	99 547	253 835	77 285	— 1 493	+ 22 262
Nova Scotia	306 210	186 128	330 191	129 383	— 23 981	+ 56 745
Ontario	1 194 785	1 328 489	1 246 969	935 978	— 52 184	+ 392 511
Prince Edward I.	78 758	14 970	88 304	14 955	— 9 546	+ 15
Quebec	1 032 441	970 791	992 667	656 231	+ 39 774	+ 314 560
Saskatchewan . . .	361 067	131 365	73 729	17 550	+ 287 338	+ 113 815
Yukon	4 647	3 865	18 077	9 142	— 13 430	— 5 277
Northwest Territo- ries	18 481	—	20 129	—	— 2 933	—

The table given above throws considerable light upon the relation existing between supply and demand with respect to the marketing of meat products in the Dominion. Reason is presented for the fact that during the past decade exports have fallen off and imports have increased, while within the past three or four years prices have advanced at an unprecedented rate. It now becomes clear that while the consuming centres have been extending in area and increasing in population, the producing areas have become depleted in population and potentially, for the present at least, not largely increased in extent. In explanation of this latter statement it should be remembered that, hitherto, grain growing and not stock raising has been the most prominent feature incident to the agricultural development of Western Canada and that the increase in the rural population of that part of the country has thus far resulted in an increased output of wheat, oats, barley and flax rather than in an appreciable extension of stock-breeding operations. Moreover, the influx of settlers has gradually entailed a systematic reduction of the prairie pasture and ranching areas, with a corresponding curtailment in the rearing of cattle under range conditions. Much of the land, therefore, which was formerly

devoted to cattle raising has, during recent years, been placed under cultivation and, in consequence, is not now producing its one-time quota of marketable animals. Mixed farming is, however, now rapidly gaining ground in Western Canada, particularly in the more northerly portions of the three prairie provinces, and this accounts for the fact that, despite the reduction in the range areas, the West has been able of late to appreciably increase its cattle stock. It would seem that a considerable extension of this movement may be confidently expected within the next few years, there having been already established there the foundations of a great cattle industry.

As casting additional light upon the present relative demand and supply of beef and beef products, reference should now be made to the changes which have taken place in our export and import trade during the past few years. The following table furnishes a great deal of useful information in this connection.

Canadian exports and imports of cattle and beef.

Year	Export cattle trade		Import cattle trade	
	Cattle Number	Beef Lbs.	Cattle Number	Beef Lbs.
1883	66 396	628 728	20 978	2 764 736
1893	107 224	356 106	1 851	5 599 113
1903	176 780	2 378 175	37 528	1 381 254
1909	162 945	1 571 585	2 601	1 306 607
1910	157 386	1 318 397	1 012	1 446 302
1911	124 923	974 411	3 044	1 170 649
1912	61 517	948 771	2 976	1 976 949
1913 (calendar yr.)	216 295	—	9 127	—

By way of comment upon the above figures it should be explained that the export trade of live cattle to the United Kingdom has practically ceased, notwithstanding the fact that this trade, for a considerable period, absorbed the best and heaviest cattle produced in either Eastern or Western Canada. The great lairages in London and Liverpool, built exclusively to handle American live cattle, now remain permanently empty. The markets of the United Kingdom have been forced to the conclusion that they can no longer draw their supplies from this continent.

As the table does not make it sufficiently clear, reference should be made, perhaps, to the peculiar situation which developed during 1913 in connection with the exportation of cattle to the United States. Practically all of the cattle exported, as credited to that year, went across the American border. Such an anomalous development, however, has been significant of only one thing; that, with the removal of the American tariff,

higher prices could be realized in the United States than in this country. The liquidation of Canadian stock continued until an equilibrium was reached, the movement further accentuating the already marked scarcity of marketable cattle on this side of the border. Never in our statistical history have prices attained so high a figure, either for cattle on the hoof or for meat in the butcher shops, as has been the case this year.

As regards prices, market returns and the movement of meat within the country, the average market returns for the past years in the case of choice butcher cattle sold in Toronto have been as follows: — In 1911, \$ 5.76 - \$ 6.10 per cwt; in 1912, \$ 6.92 - \$ 7.17 per cwt; and in 1913, \$ 6.94 - \$ 7.23 per cwt. These figures tell their own story and the facts which they suggest are fully featured in the scarcity of cattle in the country. Marketings on the whole have increased during the past few years. Particularly is this true in the case of calves, there being 112 053 head marketed at Toronto, Montreal and Winnipeg in 1909, as compared with 162 539 in 1913. It can scarcely be said, however, that the marketings of 1913 represent normal conditions, particularly in view of the large exportation to the United States.

Whereas formerly thousands upon thousands of cattle were received at the Toronto and Montreal markets for feeding and export purposes, those so received in 1913 did not total more than 2 239 head. The output of Alberta and Saskatchewan, which at one time went forward to Winnipeg, is now either consumed locally or, particularly in the case of Alberta, shipped into British Columbia. During the month of February 1913 three-quarters of a million pounds of beef were shipped from Ontario and one-quarter of a million pounds from Alberta to Canada's most westerly province. Even the prairie provinces are taking some supplies from Eastern Canada, partly through the importation of meat, but chiefly in the way of carloads of breeding cattle. In the latter movement British Columbia has also largely participated. As regards Eastern Canada, the Maritime provinces, particularly Nova Scotia, are now drawing freely from Ontario and Quebec. Very recently their receipts ran up to nearly a million pounds per month. The larger cities have each taken their quota, but fully a quarter of the amount went direct to Sydney, North Sydney and Sydney Mines in Cape Breton, where there are large manufactories of iron and steel.

A review of the facts already presented point to the one conclusion, that the country, owing to an inadequate supply, has been forced to a curtailment of meat consumption. That there is a remarkable shortage of cattle and that there has been a decrease in the per capita consumption of meat is borne out by an analysis of the figures. Notwithstanding her large area and great agricultural resources, Canada, in so far as live stock products are concerned, has now ceased, except upon occasion, to be an exporting country and has already been compelled to import considerable quantities of foreign meat. The present situation, it must be admitted, is largely consequent upon the nature of our economic development, but the causes producing it are steadily calling into being their own remedies. Everywhere throughout the country there is already on foot a comprehen-

sive movement toward the conservation of breeding stock and an extension of breeding operations. With breeding cattle in demand, with fewer calves going to the shambles and with a steadily growing domestic market, it may confidently be predicted that we are about to enter upon a period of general progress and expansion.

Up to this point, we have chiefly comprehended in the discussion the business of beef making. Special reference should now be made to the position occupied by the business of dairying in the development of cattle husbandry in Canada. There are, particularly in the provinces east of the Great Lakes, certain well defined areas where dairying and dairy cattle have for generations been directly associated with the agricultural operations of the people. In Nova Scotia and New Brunswick the Guernsey and Jersey breeds have predominated; in Quebec, the French Canadian and Ayrshire, while in the dairy sections of Ontario, the Ayrshire and Holstein have attained the preference. In certain districts of the provinces mentioned, dairying has been, for many years, almost exclusively followed and it should now be pointed out that recently, particularly in the province of Ontario and in Western Canada, dairying as an industry has made very rapid progress, its development paralleling, in part at least, the increase in our urban population. Formerly the making of cheese and butter constituted the most important part of the business. Now, on the other hand, more remunerative avenues have opened up in connection with the shipment of milk to our more important towns and cities, and with the supplying of cream to the ice cream trade and for export to the United States.

It is generally admitted that the dairy cow yields a larger economic return than does the beef steer and that milk as a wholesome, nutritious food product is cheaper than meat. While, therefore, there are large areas of the Dominion suitable only for beef raising, still, the attention of the farming public both East and West is being directed to the profit-earning ability of the cow that will produce milk.

It would almost appear that the successful future of the beef industry in this country is dependent upon the ability of the breeders of pure-bred beef stock to combine in the cattle they produce the capacity for reasonable milk production, with an inherited tendency to thick fleshing and to early maturity.

It would be of interest in an article of this kind to outline in some detail the progress and development of breeding operations in improving the type and quality of our cattle through the use of imported and home-bred pedigreed stock. The position of the Dominion, however, is now so well attested and so firmly established by the laurels won by Canadian-bred animals at International Exhibitions, where both beef and dairy breeds have been represented, as to make it scarcely worth while to dwell upon this feature of the industry. Certain of the older sections of the Dominion have long been recognized as amongst the most important and most dependable of live stock breeding grounds upon the North American Continent. Several factors have contributed to the attainment of this position, notable

amongst which in brief summary, may be mentioned: — the importation through a long period of years of carefully selected stock from the best herds of Great Britain; the climate and the character of the food which have developed hardiness, quality and finish; the competitive rivalry amongst breeders as encouraged by the great national and international exhibitions; the organization of district breeders' clubs, and the institution of the Canadian Record of Performance. Comment upon these factors is unnecessary except that it may be explained that the Canadian Record of Performance was initiated by the Federal Department of Agriculture in the interests of the breeders of dairy cattle and consists in the testing at reasonable intervals of the milk and butter-fat yield of cows whose owners apply therefor under the conditions laid down by the Department. The information which is rendered available by these records provides a standard for the selection, particularly of pure-bred sires, and its use is steadily leading to an improvement in breeding practice.

One other factor is yet to be alluded to: It is, the nationalization of the Canadian Records of pedigreed stock, which has not only made possible a systematization of our national live stock records, but has, as well, furthered and advanced in a very direct manner the business of the pure-bred stockman and the cattle industry of the country.

Until the year 1900 all the Live Stock Records in Canada were conducted by the Provincial Departments of Agriculture or by breed associations more or less provincial in character and scope. Although the most important record associations had their origin in the Province of Ontario, books of record were also established in Quebec, the North West Territories and in each of the Maritime provinces. This multiplicity of records, without uniform standards of registration, proved a source of confusion and expense to breeders and farmers and a hinderance to interprovincial and export trade. The first step taken to improve the existing situation was the passage in 1900 of an Act respecting the Incorporation of Live Stock Record Associations. Leading Record Associations promptly availed themselves of this Act and secured incorporation under Dominion charters within the next few months.

The establishing of a national system of records was the subject of discussion at many breeders' meetings up to the year 1904, when a General Convention of Live Stock Breeders from all parts of Canada was called at the instance of the Minister of Agriculture. At this Convention, committees were appointed to work out the details of a scheme providing for the nationalization of Canadian Live Stock Records, and in April of the following year another convention of delegates from each of the Live Stock Record Associations was held in Ottawa and a National Record Board established. The National Record Board is composed of representatives elected by the Boards of Directors of the various breed associations on the basis of two persons for every 100 members or under, and one additional representative for each 500 members.

It is to these men, forming the National Record Board, that the breed associations delegate the work of carrying on the National Record Office

to their mutual advantage, but with due regard to the Constitution and rules of entry of each association as laid down in the Dominion charter under which it is incorporated.

The Record Board meets annually and discusses and decides the larger questions connected with record matters. In order that the detail of registration may be efficiently looked after, an Executive Committee is elected by the Board, one man representing each class of stock as follows: — Heavy Horses, Light Horses, Beef Cattle, Dairy Cattle, Sheep and Swine. These representatives, presided over by the Chairman of the National Record Board, with a Secretary-Treasurer, constitute what is called the Record Committee. This Committee meets at sufficiently frequent intervals to look after the work entrusted to them by the Record Board in the matter of registration, which includes management of the National Records Office. This office is placed in charge of an Accountant, who is also Secretary-Treasurer of the Board and has full supervision of the several registrars and clerks. It will be seen that the work of registration is entirely under the control of the breeders themselves through their Breed Associations, Record Board, Record Committee, Accountant and Registrars. The Department of Agriculture, however, furnishes office accommodation and equipment, including stationery and other supplies, and assumes a further responsibility in connection with the work of the Records Office, to the extent of guaranteeing the authenticity of the certificates issued. That is to say, the registration certificates, after being prepared in accordance with the office records and carefully checked by the registrars, are handed over, along with the application forms received from the breeder, to an officer of the Department, who examines the certificates and compares them with the breeders' applications. If found correct, the certificates are approved by this officer, on behalf of the Minister, under his own hand and the seal of the Department.

Regarding the disposition of fees received, they are all deposited in a bank to the credit of the association for which they are sent. These monies are payable only to the order of each representative association through its officers. It is, therefore apparent that the Record Committee, after depositing these funds through the Accountant, has no further control of them.

To finance the affairs of the office, a monthly levy is made by the Record Committee on all self-sustaining associations. The amount charged for each association is based on the charges for the previous year. If the levies prove too large or too small, adjustment is made at the end of the fiscal year. The expenses of the Associations on which levy is not made are provided from a grant given by the Department of Agriculture to the Record Committee. In doing this the Department is carrying out an agreement to assist new records. The monies accruing to an association not expended as above noted, are, subject to the order of the association, to be used in meeting the expenses of officers and directors, for the purposes of publicity, or in such other ways as are provided in Section 15 of the Live Stock Pedigree Act,

It may be added that the recording of live stock under the present system is found to work very satisfactorily. The methods now followed have eliminated not only the control of records by close corporations but the possibility of the occurrence of those complications inseparable from the existence of multiplicity of records in the same country. The recording of live stock is characterized by accuracy, promptness and economy of administration, while Canadian Records are now recognized as official not only throughout the Dominion but in other countries as well.

With the single exception of the Canadian Holstein Friesian Association, which has a Dominion charter but has not yet seen fit to co-operate with the other Associations, all Record Associations in the Dominion are operated under the National Records System.

By way of general information with respect to the strength and standing of the various pure-bred Cattle Breeders' Associations in the Dominion, the following statement, setting forth the registrations for the year 1913 and the total membership to date, is submitted :

Name of Association	Registrations 1913	Membership 1913
Dominion Shorthorn Breeders' Association . . .	9 046	2 051
Canadian Ayrshire Breeders' "	3 258	1 084
Canadian Hereford Breeders' "	1 362	301
Canadian Jersey Cattle Club.	1 155	267
North American Galloway Association	23	22
Canadian Aberdeen Angus "	831	179
Canadian Guernsey Breeders' "	79	31
French Canadian Cattle Breeders' Association . .	334	172
Canadian Red Polled Association.	90	28
Holstein-Friesian Association of Canada	6 815	1 646

The Crisis in Italian Sericulture and the Measures for Averting It

by

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The production of cocoons and the silk industry are among the greatest sources of revenue of the Kingdom of Italy. The former ranges between six and eight millions sterling per annum and the latter supplies an export trade which at present amounts to about 20 millions, but which some years ago reached 28 millions. Both have very ancient traditions, for the rearing of silkworms was introduced into Calabria by the Byzantine Greeks in the

tenth or eleventh century; the Norman kings extended it to Sicily and fostered the silk industry to such an extent that between the twelfth and the thirteenth centuries Catanzaro, Reggio and Messina had famous factories producing velvets, brocades and other silken goods. Later, both silkworm rearing and the silk industry spread northwards and flourished there also. Indeed the chief characters of the greatest Italian historical novel—the “Promessi Sposi” of Alessandro Manzoni—are two humble silk-weavers of the year 1630. In the eighteenth and nineteenth centuries silkworm rearing and the industry connected with it continued their progress throughout the Valley of the Po (while they declined in the south of the country), and underwent a considerable increase owing to the excellence of the product, unequalled by that of any other country. The reeling, spinning and weaving of silk and the silk by-products industry, notwithstanding serious obstacles and several financial disasters, established themselves firmly, especially in Liguria, Piedmont and Lombardy; Como and Milan came to be as important centres of the silk trade as Lyons, Zurich or Crefeld. The service known in Italian as “condizionatura” or in French “passage à la condition” of silk, that is the deposit of the bales of silk in certain warehouses, whence samples are taken with a view to investigating the quality of the silk and determining the use to which the raw product is to be put, has attained and maintains in Milan much greater proportions than in the other silk centres of Europe.

These results are all the more worthy of consideration as they have been attained in spite of ever increasing difficulties, especially the fall in prices, the increase of the cost of production, and the customs' duties levied by the countries importing Italian silk fabrics. The fall in prices from 1s 6d or 1s 9d to less than 1s per lb. was caused by the competition of Asiatic silks, which, though much inferior to Italian silks, beat them through their lower price. Further, while the produce exported more than trebled in a quarter of a century, as the table below shows, since 1890 the wages of agricultural and industrial labour have increased by fully 50 per cent. Against the effects of this increase of cost, both the silkworm rearers and the factories opposed continued improvements in the yield and technique of their output. Lastly the silk substitutes appeared on the market: artificial silk, mercerized cotton, *viscose* and the like. Though these only take the place of silk for special purposes they contribute to reduce the demand and consumption.

The ever increasing arrivals of Chinese and Japanese silks on the European and American markets have altered the relative position of Italy in the world's market as shown by the figures in Table I. From them also it is easy to judge to what an extraordinary degree the consumption of silk has increased, notwithstanding the increased production of substitutes (1).

(1) These data have been collected by the “Union des Marchands de Soie” of Lyons, and published in the *Bollettino di legislazione commerciale e doganale*, Part II, 1890, p. 614, 1903, p. 388; 1913, p. 1034.

TABLE I. — *Average yearly production of silk (in metric tons).*

Country	1885-1889	1899-1903	1907-1911	1912
Italy	3 113	4 272	4 190	4 105
France	669	599	542	505
Spain	66	81	82	78
Austria-Hungary	245	300	352	294
Total Europe	4 093	5 252	5 175	4 982
Levant and Central Asia	667	2 083	2 903	2 233
Exports from Shanghai	2 549	4 598	3 222	6 400
" Canton	1 149	2 153	2 258	2 260
" Yokohama	1 928	4 309	3 124	10 867
" Calcutta	553	290	261	133
Total of the whole world	10 939	18 685	23 943	26 915

The ratios between the figures for the period 1885-1889 and those given above for 1907-11 show how the individual States have modified their output :

Italy	from 1 to 1.35
France	" " " 0.80
Spain	" " " 1.24
Austria-Hungary	" " " 1.43
Levant and Central Asia	" " " 4.36
Exports from:	
Shanghai	" " " 2.04
Canton	" " " 1.96
Yokohama	" " " 4.21
Calcutta	" " " 0.47

While the European and American world increased its demand for silk by 13 000 metric tons, Europe contributed only about 1000 tons, the remaining 12 000 being supplied by China and Japan and forming the basis of the great business and trade activity of the last decade in the Far East. Italy's contribution, which between 1885 and 1889 amounted to 28.4 per cent. of the total silk, fell to 17.3 per cent. in 1907-11. According to our statistics the production of fresh cocoons, which was from 38 000 to 40 000 metric tons between 1880 and 1889, reached 57 300 tons in 1900 to 1904 and in the succeeding years fell to the following figures :

Production of cocoons in Italy from 1905 to 1913 (in metric tons).

Year	Tons	Year	Tons
1905	51 940	1910	47 964
1906	53 838	1911	41 951
1907	57 058	1912	47 470
1908	53 193	1913	38 490
1909	50 760		

The prices of the raw material and of silk were in keeping with this trend of affairs. Up to 1875 they were high, as much as 1s 6d, 1s 9d and 2s 2d per pound of cocoons, and sometimes even 36s per lb. of silk; after 1880 they varied as follows:

Periods and years	Prices at Milan, per lb. in gold			
	Fresh cocoons		Raw silk (sublime $\frac{10}{12}$ brand)	
	s	d	s	d
1880-1884	1	5	19	7.4
1885-1889	1	2.8	17	9
1890-1894	1	2.4	17	9.4
1895-1899	0	9.8	16	0.6
1900-1904	1	0.8	16	6.3
1905-1909	1	2.9	17	6.8
1910	0	11.6	15	3.6
1911	1	0.3	15	3.6
1912	0	10.5	14	9.1
1913	1	1.6	17	1.2

After 1900 the highest prices of cocoons were in 1907, namely 1s $5\frac{1}{2}$ d with the raw silk at 18s $2\frac{1}{4}$ d; but in 1908 and 1909 the former fell to 1s 1d and 1s 3d and the latter to 15s 8d and 16s 6 $\frac{3}{4}$ d.

At the same time, this fall in prices, due to competition from China and Japan, allowed the world's consumption to quadruple itself in thirty years, as the use of silk extended to all classes; this gave a fresh impetus to the industry. But the same causes produced difficulties for the Italian industry and rearing, especially in conjunction with the increased cost of labour. The rearers and manufacturers fought against these difficulties and held out for over ten years, so that up to 1907-08 the increase in the production of cocoons kept pace with the increase in the silk trade shown by the following figures (in millions of francs):

Periods and years	Imports	Exports
1891-1895	114.6	321.8
1896-1900	147.3	410.9
1901-1905	218.5	555.6
1906	250.5	683.7
1907	314.0	710.2
1908	242.5	553.4
1909	236.3	615.6
1910	269.5	583.1
1911	259.7	505.7
1912	212.8	549.5
1913	200.3	497.1

The data on the commercial activity also show an *optimum* in the period 1905-1907, in which the imports averaged about £10 000 000 per annum and the exports about £26 600 000. But from then up to 1913 there is a fall of about £8 800 000 in the total trade, which is a very eloquent index of the difficulties against which silkworm rearing and the silk industry have to contend. They have had to struggle for several years against low prices and sometimes even to work at a loss and to resist the formidable competition previously mentioned. This explains the recent decrease of the home production, which in its turn is a source of serious embarrassment to the industry, depriving it of the exceptionally good raw material which alone can supply the classical raw silks for the trade and the first class fabrics of the Milan and Como looms. It is one of the chief causes of the decreased exports, which concern more raw silk than the fabrics, as the deficiency in raw material from the country cannot be replaced by Asiatic cocoons.

It will thus be readily understood that all engaged in the silk industry follow with the greatest interest the efforts made to increase silkworm breeding in Italy and especially in the south, where it was once flourishing. During the last twenty years the Italian bibliography on agriculture, silkworms and silk is full of works which treat of this increase and aim at furthering the planting of mulberries and raising worms in Southern Italy. It may be assumed that this object will be attained, for the history of Italian sericulture shows that it has contended with and overcome more than one serious obstacle in the past.

Thus in 1850-55 it received a severe blow from the invasion of pébrine, which carried off half the worms and almost annihilated silkworm breeding in the South. At this time the producers of silkworm eggs of the north of Italy had resort first to Turkey and Anatolia, then to Persia, Turkestan and China, and lastly to Japan, thus saving the national silkworm breeding and silk industry. Meanwhile distinguished scientists investigated the causes of the diseases of worms; Dubini had already discovered *Botrytis bassiana*, the cause of muscadine, in 1832, and later Emilio Cornalia discovered the corpuscles of pébrine and proved the hereditary transmission of the disease. Pasteur in France and Gaetano Cantoni in Italy, availing themselves of the discovery, invented the cellular method of preparing silkworm eggs with the aid of microscopical examination, thus allowing the reconstitution of the old Italian breeds. This gave rise to a new industry, the preparation of eggs free from pébrine. At the same time the technique of spinning and weaving made wonderful progress, the industry of silk by-products was founded and our silk fabrics steadily gained ground on foreign markets.

The State on its part favoured the movement by founding the Padova Silkworm Breeding Station under the direction of the famous silkworm expert Verson, and silkworm observatories; it arranged for instruction on the subject to be given in agricultural schools, as well as by the travelling lecturers; it held special competitions, founded schools of weaving and silk dyeing at Como, and assisted industrial and technical educa-

tion. In addition to all this, private initiative joined in the work, chiefly by instituting cooperative esiccators, that is establishments in which the cocoons of the agricultural members are suffocated, dried and stored, thus avoiding the necessity for selling the fresh produce within a few days (1). A private society, the "Anonima Cooperativa per la Stagionatura delle Sete" of Milan, founded and kept up by itself the laboratory for the study of silks, from which very valuable contributions to the technique of the industry have been and are being made.

Altogether few Italian sources of production and of industrial activity have been the object of so much study and free and successful initiative as silkworm raising and the silk industry.

Among the difficulties mentioned above, must be included a parasite of the mulberry, *Diaspis pentagona*, a most injurious scale insect from Japan which invaded the mulberry plantations in 1890. For its control it became necessary to enact laws rendering obligatory the use of certain insecticide emulsions, but the work of scientists was still more beneficial. Prof. Antonio Berlese discovered an entomophagous parasite, *Prospaltella berlesei*, which now successfully controls the Japanese fruit scale. Meanwhile, however, in many localities numbers of mulberries had perished or were in such a bad state as to induce the farmers, tired with the struggle against so many adverse conditions, to cut them down.

The above-mentioned efforts to improve the conditions of sericulture were not sufficient, in view of the many difficulties which beset it, to attain their aim, and the Government had naturally to take the matter into serious consideration, owing to the great interests involved. After several measures, in January 1907 the Government decided upon an enquiry by a Commission under the presidency first of the Hon. L. Luzzatti and then by the Hon. Senator Cavasola, at present Minister of Agriculture. The Commission presented its report in 1910; this dealt with the conditions of Italian sericulture, the causes of its depressed state and the measures to be adopted. It is naturally impossible to give a résumé of it here; it will be enough to say that the Commission declared in its conclusions that the greatest evil which afflicted the silk industry was the want of organization, and it proposed the foundation of a Silk Institute as an independent body for the object of furthering the progress and the improvement of sericulture. Besides this measure, it recommended suitable provisions for credit, for the railway tariffs, for the carriage of cocoons, silk and silk fabrics, and for the customs tariffs, with the object of facilitating the importation of raw materials required by the industry. It advocated also the extension of instruction in silkworm rearing and mulberry growing, especially in the colleges at Milan, Perugia and Portici. It demanded especially that the State should aim at obtaining an increase and a progressive improvement in the production of national raw material, so as to supply completely the Italian

(1) One of the most important esiccators is that of Cremona, which was founded chiefly by the exertions of Prof. Antonio Sansone, then director of the travelling professorship at Cremona and now Director-general of Forests.

factories and to keep up the character of Italian goods, which cannot be given by the raw material of other countries. Lastly the Commission asked that a complete and accurate study be made of the foreign silk trade and industry. The proposal of the foundation of the Silk Institute was not, however, accepted by Parliament, which nominated a Council for the Silk Interest, allotting to the Ministry of Agriculture £48 000 per annum for the above-mentioned objects, including the sending of special delegates to the East, to some countries in Europe and to New York, with the object of keeping in touch with the trade in raw material and in silken fabrics. The above sum was distributed as follows: For promoting silkworm rearing, mulberry growing, studies on silk, foundation of cooperative associations, etc., £20 000 and £4 000 in the financial year 1912-13. For the intelligence service and statistics £4 000. For the establishment of mulberry groves and distribution of mulberry trees, prizes to agricultural societies and farmers, control of *Diaspis*, etc., £10 000. For the increase of the endowment of the Como school of silk industry, for the new station of Ascoli, for the increase to the contribution to the Padua Station and for the three chairs at Milan, Portici and Perugia, £6 000. For scholarships to special courses of silkworm rearing at the above schools and other forms of propaganda, £4 000; for increased subventions to travelling lectureships, £4 000. Lastly, for the first cost of the plant of the newly founded institutions and chairs and for the increase of the plant of the already existing ones £10 000.

The Silk Council was definitely constituted in July 1912 and has now actively entered upon its labours. It has appointed technical delegates in China, Japan, New York and other localities. It has turned its attention to the furtherance of professional instruction and provided for the encouragement of mulberry growing and silkworm rearing in all the regions of Italy; special attention has been paid to the south, which used to produce and still produces cocoons yielding abundance of good silk, notwithstanding the imperfections in the technique of managing the worms. During the 1914 season the Council started the publication of a Bulletin containing information on the cocoon crop in Italy and abroad and on every subject likely to interest the silk market.

The Ministry of Agriculture in its turn, availing itself of schools, travelling lectureships and other kindred institutions and of the above-mentioned funds, has begun a liberal distribution of mulberry trees and of silkworm eggs; it has organized special courses of instruction and has encouraged a number of breeders with an ample distribution of suitable instructions. Among these, special stress is laid on those which tend to teach the methods of diminishing expenses and consequently the cost of mulberry leaves and of cocoons.

As for the former, it has been recognized as advantageous in many instances to replace standard mulberry trees by hedges, low pollards, and so-called mulberry meadows, a kind of coppice which is cut every year and which renders the collection of the leaves much less expensive. In rearing, the breeders are advised, instead of feeding the worms on detached leaves, to give them whole shoots or twigs, as has been practised for a long time past

in Venetia. As regards the lack of housing, especially in the South, it has been shown that the Persian sheds or *tilimbars* are very convenient; these are built of poles and branches of trees at the beginning of the season and are dismantled as soon as the cocoons are gathered. Several tests of the system, especially those carried out at the Portici Agricultural College by Prof. Gustavo Leonardi, have demonstrated its superiority over other systems and its economy, especially under climates favourable to the worms like that of the South of Italy.

The above-mentioned law has provided for the greater and permanent spread of instruction and experimentation by founding a second Silkworm Rearing Station at Ascoli and three new chairs of silkworm rearing and mulberry growing at the Milan, Perugia and Portici Colleges. Many of these institutions are already in full work, and others will soon be founded; with them the whole series of measures for the attainment of the objects above-mentioned will be completed. The Divisions of Industry and Agriculture are actively devoting themselves to the work, whilst the Silk Council in its turn contributes opportune suggestions and expresses the real conditions and requirements of the country. Everything encourages us to hope that two of the most ancient and important sources of wealth, increased and strengthened by their own activity without artificial help and fiscal protection, will soon resume the place they once occupied in Italian public economy.

SECOND PART. ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION.

870 - Agriculture in Sweden.. — *Sweden, Historical and Statistical Handbook*, published for the Government by G. GUINCHARD; second part: *Industries*, pp. 29-232. Stockholm, 1913.

In the year 1910, out of the 5 522 000 inhabitants of Sweden, 2 663 000 or 48.23 per cent., were occupied in agricultural pursuits; in 1900 the percentage was 53.67 and in 1870, 71.87. Since 1880, in spite of the steady increase of the population, there has been also an absolute decrease in the agricultural population which then numbered 3 078 000 persons.

The cultivated area of the country was divided in 1911 among 359 871 farms, with an average area of about 25 acres under cultivation. The size of the farms has a very wide range. In the official statistics the groups according to size are as follows :

Size-group	Relative number
Up to 5 acres	25 per cent
5 to 50 "	64 "
50 to 250 "	10 "
over 250 "	1 "

As regards the area of cultivated land, small farms up to 25 acres and large ones over 125 acres each account for about $\frac{1}{4}$ of the total, the other half being occupied by the medium-sized ones. The extensive plains with fertile loam and clay soils in Central and Southern Sweden have relatively many large farms, while small farms are prevalent in the higher or hilly districts in the west and north of the country, on sandy and gravelly soils, where the cultivated land is cut up by mountains, woods and moors.

DEVELOPMENT
OF
AGRICULTURE
IN DIFFERENT
COUNTRIES

In general in Sweden, farmers own the land they farm; in 1911 only a little over 14 per cent. of the whole number of farms were rented. Among the smaller farms renting is particularly uncommon (10 and 13 per cent. in the two smaller size-groups), while in the two groups of larger farms, with over 50 and over 250 acres, it is more frequent (31 and 35 per cent.).

In 1911 the total area of the country, 101 566 950 acres, was divided as follows:

Fields and gardens	9 144 700 acres or	9 per cent.
Meadows	3 226 325 "	3.2 "
Woods	52 828 600 "	52.0 "
Other descriptions	36 367 325 "	35.8 "

The arable area of Sweden has quadrupled in the last century. Table I shows the changes which took place in the areas occupied by the various crops between 1865 and 1911:

TABLE I. — *Area under chief crops in 1865 and 1911.*

	1865	1911	1865	1911
	acres	acres	%	%
Cereals	2 908 500	4 141 600	50.5	45.9
Forage crops	1 569 200	3 355 800	27.2	37.1
Root crops	333 600	635 100	5.8	7.0
Other crops	51 900	7 400	0.9	0.1
Fallow	902 000	892 100	15.6	9.9
Total	5 765 200	9 032 000	100.0	100.0

The relative areas under the various kinds of cereals have changed considerably in the course of time; barley, which was formerly the cereal most grown, has gradually lost importance, with the exception of Upper Norrland where it takes preference to other grain on account of its earlier ripening. As breadstuff barley has been chiefly replaced by rye; at the beginning of the 19th century the quantity of barley and rye harvested was about equal, while at the end of the century the rye crop was nearly twice the barley. Of late years the area under wheat has grown steadily, without however ceasing to hold the lowest place among the four leading cereals both for area and total yield. Oats have gained most of all in importance, now occupying almost half the area under cereals in the country; the crop is equal to that of barley, rye and wheat together, besides which, the bulk of the increasingly grown mixed grain is oats.

Of less importance in area occupied and in value are pulse crops (peas, beans, and vetches) and buckwheat, which is now grown only to a limited extent in the poorest sandy regions of Schonen.

With the increase in area under cultivation an increase of yield per acre has also taken place; it is due to improvements of the land, more

TABLE II. — *Area and yield of grain and pulse crops.*

Period	Total	Wheat	Rye	Barley	Oats	Mixed grain	Pulse
<i>Area (in acres).</i>							
1801-1820*	1 364 300	37 450	444 750	397 750	280 500	142 100	61 750
1821-1840*	1 789 850	53 900	583 200	463 300	375 600	202 600	111 250
1841-1860*	2 251 250	82 250	722 750	519 000	559 700	231 650	135 900
1861-1880*	3 187 580	143 927	877 382	556 492	1 275 241	198 638	135 900
1881-1890*	3 860 790	180 144	940 678	557 285	1 816 181	235 908	139 595
1891-1900*	4 170 709	179 356	1 001 475	542 999	2 024 808	296 369	125 702
1901-1905*	4 226 116	200 721	1 015 123	527 718	2 037 934	338 287	106 333
1906-1910*	4 170 192	226 302	1 002 152	*470 034	1 987 278	383 227	101 198
1911.	4 142 411	250 704	988 803	446 133	1 951 862	403 871	100 978
<i>Yield (in metric tons)**.</i>							
1801-1810*	620 700	16 200	195 000	200 000	120 000	64 000	25 500
1811-1820*	691 800	19 800	224 000	220 000	130 000	70 000	28 000
1821-1830*	813 200	30 000	280 000	230 000	140 000	84 200	49 000
1831-1840*	864 400	35 000	315 000	225 000	155 000	86 900	47 500
1841-1850*	1 029 000	43 000	347 000	270 000	1 94 000	110 000	65 000
1851-1860*	1 354 500	62 000	455 000	308 000	348 000	118 500	63 000
1861-1870*	1 540 000	70 000	455 000	300 000	560 000	101 000	54 000
1871-1880*	1 802 602	91 400	495 200	341 754	773 632	113 931	76 685
1881-1890*	2 138 217	101 800	520 700	336 155	960 467	140 115	72 980
1891-1900*	2 342 900	123 300	580 600	314 500	1 074 800	184 300	65 400
1901-1905*	2 138 587	130 177	555 937	282 959	920 365	195 902	42 146
1906-1910*	2 539 203	191 800	593 865	299 629	1 123 228	276 951	53 639
1911.	2 477 803	217 844	592 949	289 401	1 039 540	284 394	53 675

*Yearly average for the period.

** One metric ton = 0.9842 English ton, or 1.10231 short ton.

TABLE III. — *Importation and exportation*

	Wheat, whole and milled			Rye, whole and milled		
	Import	Export	Excess of import	Import	Export	Excess of import
1816-1820.	1 505.7	129.7 —	1 376.0	16 098.7	114.5	15 984.2
1821-1840.	159.5	794.2 +	634.7	4 330.7	1 246.6 —	3 084.1
1841-1860.	2 454.9	3 662.7 +	1 209.8	13 343.8	13 109.1 —	234.7
1861-1880.	27 087.3	10 137.6 —	16 949.7	106 274.1	3995.9 —	102 278.2
1881-1890.	83 796.6	6 851.8 —	76 944.8	173 502.8	3096.1 —	170 406.7
1891-1900.	146 558.0	1 151.8 —	145 406.2	114 212.1	2324.4 —	111 887.7
1901-1910.	207 102.5	180.9 —	206 921.6	94 438.1	4844.3 —	89 593.8
1911.	181 740.5	829.9 —	180 910.6	52 805.6	1473.0 —	51 332.6
1912.	179 860.0	795.3 —	179 064.7	116 762.8	435.0 —	116 327.8

abundant and suitable manuring, more thorough tillage, and the introduction of a more intensive rotation. The changes which have taken place in the acreage and yield of the various cereals and pulse crops since 1800 are shown in Table II.

Notwithstanding the increase in the production of grain in Sweden, namely from 598 lbs. per inhabitant at the beginning of the 19th century to 1 045 lbs. at present, among which breadstuffs figure for 205 and 315 lbs. respectively, a good deal of the constantly increasing consumption has to be met by importation.

In most of the twenties of last century the breadstuffs (wheat, rye and barley) harvested were sufficient for the wants of the country and soon an increasing export trade began, at first only with oats, but in the forties with barley, rye and wheat. In 1860, however, most of the exports ceased and the importation of wheat and rye in constantly larger quantities set in; up to the middle of the eighties this was partly balanced by the exportation of oats, but after that time this also began to slacken, owing to the rising demands of the developing animal husbandry; the result is that since 1902 the imports have been in excess of the exports by 2 to 3 millions sterling per annum. The condition of the trade is shown in Table III.

The following root crops besides potatoes are grown in Sweden: beets and mangolds, Swedes, turnips and parsnips. Between 1901 and 1910 about 1 450 100 tons of potatoes were grown yearly on 378 693 acres; this gives 614 lbs. per inhabitant, which is not much below the average figure for the west of Europe, namely 682 lbs.; deducting the seed (or about 10 cwt. per acre) there remains available for consumption 535 lbs. per inhabitant. Every year about 100 000 tons are used by the distilleries,

of cereals (in metric tons).

Barley			Oats		
Import	Export	Excess of import	Import	Export	Excess of import
6 082.6	2 07.9	— 5 874.7	521.4	430.8	— 90.6
2 919.5	1 647.1	— 1 272.4	597.3	2 790.0	+ 2 192.7
2 129.3	12 907.3	+ 10 778.0	110.4	28 647.9	+ 28 537.5
6 371.5	29 663.1	+ 23 291.6	541.1	189 174.0	+ 188 632.9
8 033.0	23 146.7	+ 15 513.7	2 930.7	197 710.0	+ 194 779.3
6 235.9	2 023.6	— 4 212.3	11 773.5	87 899.1	+ 76 125.6
2 487.1	87.1	— 2 400.0	69 052.8	9 021.8	— 60 031.0
1 279.5	5 379.5	+ 4 100.0	102 051.9	28 091.8	— 73 960.1
6.1	3277.4	+ 3 271.3	97 288.8	5 236.8	— 92 052.0

The area under sugar-beets has increased from about 45 000 acres in the mid eighties of last century to 75 000 acres in 1911; the average crop for the period 1901-10 was 8 130 000 tons, or 11 tons per acre. The sugar content has steadily increased, the yield of unrefined sugar having risen from 6.6 per cent. in 1870 to 15.72 in 1911.

Forage crops were grown in 1911 on 3 355 227 acres, or 37.1 per cent. of the cultivable land. The forage plants most commonly grown are timothy and red and alsike clovers. The yield of grass leys is, according to official statistics, about 20 to 28 cwt. per acre, making altogether between 3 and 4 million tons; to this must be added the hay from natural meadows, at 8 or 10 cwt. per acre., or about 1 ½ million tons. Accordingly the whole hay crop, not including pastures, amounts to upwards of 5 million tons, worth about £14 000 000, or a third of the value of the total produce of the country.

Sweden possesses a great extent of pastures, but there are no available data as to their area and yield.

The area devoted to the cultivation of plants other than grain, root and forage crops, amounted, in 1911 to only 4038 acres, of which 3783 were under textiles.

The land in Sweden devoted to horticulture is given for the same year at 112 978 acres, or about 1.25 per cent. of the cultivated area. Fruit growing is the principal branch and is carried on intensively in some localities. The growing of flowers under glass has also considerably developed and vegetables are grown all over the country both for private consumption and for sale. Schools for gardeners exist at Alnarp in Schonen, Adelsnäs in Östergötland, Experimentalfältet near Stockholm and Härnösand in Norrland. Special schools of gardening for women are those at Exper-

näs in Närke and Torshäll in Dalarne. Cooperation in horticulture is in a flourishing condition.

Animal husbandry (1) has been from time immemorial the chief branch of agriculture in Sweden. According to official statistics the live stock in 1911 consisted of the following :

1 Horses		Steers	Bulls	Cows	Cattle under 2 years	Sheeps	Goats	Pigs	Reindeer
under the age of 3 years	over 3 years								
493 322	95 163	144 277	52 467	1837 038	655 830	945 709	66 136	951 164	276 084

By the thirties of last century the importance on a large scale of foreign, especially English, breeds of live stock had already begun and the State promoted breeding by the institution of central breeding farms for cattle and sheep ; these were, however, broken up about the end of the 19th century and the stock sold off. The proceeds were devoted to a "Fund for the improvement of Swedish cattle and sheep". Among the general measures adopted for the promotion of animal husbandry, prize giving is now the most important. There are prizes for horses, cattle, sheep and pigs. In 1911 the amount spent in prizes for cattle was £19 350 of which the State contributes £6 600.

At present the five following breeds of cattle are awarded prizes.

1) The *Fjäll* (North Swedish cattle) in Norrland and Dalarne ; the cows yield about 550 gallons of milk per annum with an average fat content of 3.8 per cent. ; their live-weight is about 770 lbs.

2) The *Swedish Red Poll* in Dalarne, Bohuslän and other districts ; their milk yield and live-weight are about the same as in the *Fjäll*.

3) The *Ayrshire* in Southern and Central Sweden ; the cows give about 770 gals. of milk containing an average of 3.6 per cent. of fat ; their live-weight is about 1000 lbs.

4) The *Red Spotted Swedish* in Central Sweden ; yearly milk yield about 880 gals. with 3.8 per cent. fat ; average live-weight 1100 lbs.

5) The *Black Spotted Swedish Lowland* in Southern Sweden ; milk yield 990 gals. with 3.3 per cent. fat ; live-weight about 1265 lbs.

In the year 1911, 58 020 animals were exhibited, 50 761 taking prizes. Besides the awarding of prizes the following measures have also largely contributed to the success of Swedish animal husbandry : the institution of herd books, the auctions of breeding cattle, the competitions for the formation of cattle-breeding centres, the record associations and the veterinary and educational services.

In the breeding of horses heavy draught horses occupy a prominent position. To this type belong the Dalbo horse in Dalsland and northern Bohuslän and the North Swedish horse. They are rather small but power-

(1) See also E. O. ARENANDER : " The recent development of Cattle Breeding in Sweden ". — B. Oct. 1913, pp. 1502-1511. (Ed.).

ful, resistant and exceptionally thrifty animals. In order to give the Swedish horse more bulk and strength the following foreign strains of blood have been introduced, especially since the middle eighties of last century: Percherons, Pinzgaus, Clydesdales, Norwegians and Belgians. The first two have not had any notable influence on the native breeds. Clydesdales, which in Wästergötland laid the foundation of the Levene horse, have had a certain importance, especially in the beet-growing districts; but they are giving place to Belgian Ardennes, which have been crossed with the native breed to produce a compact, powerful horse with lively action (1). In 1901 the studbook for Swedish Ardenne horses was founded; out of the hundred or so stallion and horse-breeding associations existing in the country about seventy aim at the production of an Ardenne type.

Of much less importance than the breeding of draught horses is the breeding of half blood horses, which are chiefly devoted to the production of army remounts. For these there are two stallion depots: Flyinge in Schonen and Strömsholm in Västmanland, with about 230 stallions. Of these about 20 are English Thoroughbreds, the rest Hanoverians and East Prussians. The breeding of Thoroughbreds in Sweden is insignificant. The breeding of ponies gains constantly in importance; the demand for ponies is met by importation from Iceland.

The breeding of pigs has gained much importance since the beginning of this century. The pig-breeding associations and stations are assisted by the State. Only English Large Whites and Swedish or Danish pigs are awarded prizes.

Sheep breeding is constantly losing ground. For the improvement of the sheep Cheviot rams, some imported from Scotland and some raised in Gottland, are used. In Southern and Central Sweden some English breeds, such as Oxford, Shropshire and Southdown, are kept. Merincs, which in the eighteenth century were very numerous, are now reduced to two or three hundred head in Södermannland and Östergötland.

The breeding of reindeer is more important. In Sweden a distinction is made between the high mountain reindeer and the forest reindeer. The former spend the summer in the high mountain land and only the winter in the woods, while the latter live throughout the year in the woods. The value of the Swedish stock of reindeer may be estimated at about £250 000, while its yearly returns are upwards of £55 000.

Poultry breeding is highly developed in the south of Sweden. There is a considerable exportation of eggs and birds. The number of head of poultry is estimated at 4 250 000. The General Poultry Association founded in 1898 included, in 1910, 23 district associations with 6601 members. There were also in the same year sixty egg-purchasing cooperative associations within the Län Malmöhus; these collected eggs from 160 receiving stations.

(1) See No. 754, B. Aug. 1914.

Bee-keeping has also made considerable progress during recent years. The number of hives in 1911 was at least 120 000 ; the yearly output of honey was estimated at 1 320 000 lbs. and that of wax at 23 760 lbs.

Table IV shows the foreign trade in animals and their products in recent years.

TABLE IV. — *Imports and exports of animals and their produce.*

	Imports		Exports			
	1908	1912	1908	1909	1910	1911
Horses head	1 953 ^a	2 224	3 991	2 514	4 264	6 803
Cattle "	4 817	2 806	9 767	12 558	33 437	34 349
Sheep "	91	141	1 753	1 761	1 920	2 087
Pigs "	6 528	5 358	10 126	61 007	53 885	199 404
Pork lbs.	10 150 899	3 350 171	6 124 298	4 756 011	6 581 571	25 220 230
Other meat . . "	5 358 032	4 072 983	1 370 255	2 000 383	6 445 441	19 139 989
Cheese "	804 047	1 276 464	4 611	129 892	51 058	11 946
Butter "	275 051	272 547	346 784	48 274 065	47 849 903	46 720 788
Margarine . . "	6 017	325 224	1 015 879	215 983	202 200	48 710
Lard "	4 874 252	1 911 945	109 571	22 222	58 089	32 769
Tallow "	13 653 977	6 756 774	1 772 593	1 110 809	1 989 123	1 331 770
Hides, unworked "	16 975 185	26 342 622	14 885 506	19 862 174	22 164 857	25 156 483
" worked "	1 518 783	2 182 275	426 208	118 250	147 213	271 053
Bones and bone meal "	19 675 379	14 146 612	67 021	52 811	358 701	2 339 557
Wool "	12 275 047	145 721	71 093	208 580	140 424	136 004
Honey "	151 954	41 111	1 373	163	684	315
Wax "	43 858	68 919	11 669	6 574	7 084	2 548
Eggs No.	55 876 176	54 915 386	38 837 492	37 358 122	41 516 566	44 759 409

Dairying in Sweden, the history of which can be followed back for seven centuries, has developed very considerably since the milk separator was invented in 1878. In 1910 there were 1382 dairies in the country ; of these 542 were cooperative dairies, 457 collecting dairies, 276 estate dairies and 107 estate collecting dairies. Cooperation is most widely diffused in the southern and northern parts of the country, while in Central Sweden the estate and collecting dairies prevail. In 1911 the total amount of milk delivered at the dairies was 252 828 394 gals., of which 30 133 330 gals. were sold as whole milk ; the rest, upwards of 220 000 000 gals., was used in the manufacture of cheese and butter. The dairies producing only butter numbered 845, while 327 produced only cheese, and 208 both

butter and cheese. The amount of butter produced is constantly increasing; it was 57 450 840 lbs. in 1900, 61 598 700 lbs. in 1905 and 72 464 577 lbs. in 1910. The production is most intensive in Schonen and Halland, where in 1910 about half of all the butter produced in the country was made. Of the butter exported, 75.01 per cent. goes to England, 20.74 per cent. to Denmark and only 3.92 per cent. to Germany and 0.33 per cent. to other countries. The preparation of cheese has made slow but steady progress during the last twenty years; the increase is observed only in fat cheeses, the production of the other cheeses being on the decline.

Further assistance to dairying in Sweden is offered by the labours of dairy instructors and advisers, by the schools of dairying, by the dairy stations, exhibitions and the organization of the examinations of butter (the butter that has been examined being distinguished by a special mark).

The Royal Agricultural Department, under the Ministry of Agriculture which was instituted in 1900, is at the head of the State agricultural advisers, of the peat and fishery inspectors and of the 22 agricultural engineers; with the 26 Chambers of Agriculture at present existing, it takes all the public measures calculated to promote agriculture or proposes them to the Ministry.

Sweden possesses at present 15 farming schools, 33 schools of agriculture in which practical and theoretical courses lasting at least 20 weeks are held, two upper housekeeping schools in which women teachers of housekeeping are trained, two agricultural institutes for higher agricultural education (Alnarp and Ultuna), three schools of farriery and one veterinary college (Stockholm).

Further chapters treat of agricultural credit, of the control and experiment services (17 chemical control stations, one State central institution for agricultural experimentation and several other experiment stations connected with the agricultural institutions or founded by associations and chambers of agriculture, 17 seed control stations), of the question of seeds (Society for the Improvement of Agricultural Plants, Swedish General Seed Company and Svalöf Institute (1)), the work of the Swedish Moor Cultivation Society and other agricultural associations, the measures for promoting agricultural book-keeping, the question of agricultural labour, and agricultural legislation in general and that of farm renting in particular.

Forestry is discussed in a section by itself, from which a few figures are here given to show the importance of forestry in Sweden. Of the whole area of the country, 52 per cent. is covered by forest; that is 969 acres per 100 inhabitants, while Russia has only 415 for the same number. The 52 million acres of forest represent a total value of about £85 756 000. Only one-third of the forests are property of the State or of public bodies,

(1) See NILSSON: "The Swedish Institute for the Improvement of Field Crops at Svalöf". — *B. June 1913*, pp. 834-843. (Ed.).

the rest being private property. In 1911, 1 329 million cub. ft. of wood were cut; in 1913 the value of wood imported amounted to £1 049 000 against £16 595 000 exported.

RURAL
HYGIENE

- 871 - **Control of Beri-Beri: Curative Action of Autolysed Yeast Against Avian Polyneuritis.** (1) — COOPER, EVELYN ASHLEY (Beit Memorial Research Fellow, Lister Institute) in *The Biochemical Journal*, Vol. VIII, No. 3, pp. 250-252. Cambridge, June 1914.

The autolysis of yeast was obtained by placing pressed brewers' yeast in a flask in a hot room (35° C.) for 36 hours, when the yeast was rapidly converted into a brown fluid. This was filtered and the residue washed with a little water. Pigeons affected with polyneuritis were readily cured by 3 cc. of this liquid.

Experiments were also made with air-dried yeast, which had been stored for six weeks; to this some water was added and it was then allowed to autolyse at 35° C. for 48 hours; the filtrate was found equally curative.

The writer summarizes the results obtained as follows:

1. By the autolysis of brewers' yeast a solution can be obtained which possesses as marked curative properties towards avian polyneuritis as the original yeast.

2. The solution retains its curative power for at least eight weeks and when given orally to birds in doses 10 times as great as the minimum curing dose has no toxic action.

3. An air-dried yeast retains its curative power after storage for two years in a dry tin, and still autolyses after storage for four months.

The writer concludes that the autolysis of brewers' yeast should afford a simple and inexpensive method of preparing a non-toxic solution suitable for the oral treatment of human beri-beri.

AGRICULTURAL
EDUCATION

- 872 - **American Black Flies.** — NALLOCH, Y. R., in *U. S. Department of Agriculture, Bureau of Entomology, Technical Series*, No. 26, pp. 72 + 6 plates. Washington. April 6, 1914.

The *Simuliidae* are of considerable economic importance as parasites of domestic animals and man. The writer gives a classification and scientific description of the American species in all phases of their life cycle, based on a study of the collections in the United States National Museum. He distinguishes 5 species of *Prosimulium*, one of *Parasimulium* and 29 of *Simulium*. A bibliography of 26 works on the subject is appended.

- 873 - **Agricultural Schools in Panama.** — *Daily Consular and Trade Reports*, Year 17, No. 172, p. 476. Washington, July 24, 1914.

Two agricultural schools are to be established in Panama. One of the schools will be located near New Gorgona. The Government is also contemplating the establishment of an agricultural experiment station.

(1) See also No. 1130, B. Aug. 1912.

874 - The Experiment Farm at Genale, Italian Somaliland. — ONOR, R. (Agricultural Adviser at Genale) in *Giornale di Agricoltura della Domenica*, Year XXIV, No. 30. Piacenza, July 26, 1914.

The fundamental technical problem in the agriculture of Benadir is that of irrigation. When that is overcome one may say that, apart from questions of practical convenience, almost every tropical crop is possible. On the other hand the draught animals are liable to serious parasitic diseases, so that the questions of cultivation of the land and transport become an additional problem. Further, in addition to these and other technical problems of first-rate importance, is the question of the economic value of the various crops.

In view of these facts the Government decided on the formation of an experiment farm at Genale, to which the Governor added four farms to be allotted to four families of Italians with a view to facilitating a preliminary colonization experiment. In February 1912 the first huts were built, and the station is now assuming its normal aspect with brick buildings constructed locally.

The mechanical elevation of the water for irrigation, which has been provided for at Genale by centrifugal pumps worked by oil engines, the study of the possible utilization of the wind, and the application of motor power to agricultural work and transport, are all questions for investigation which will entail considerable funds. Further, the administrative side of the farm will render assistance by providing information of great practical value. The book-keeping, which during the initial period was, owing to the opportunity offered, concerned only with certain items of outlay, is now carried out like that of any private enterprise.

The progress of the scheme has not so far allowed well organized experiments to be conducted, especially as the largest share of attention had to be given to crops which seemed likely to be of the greatest economic importance in Benadir. Among the plants already studied and those under experiment are the following:

- I. Starch-producing plants: *Manihot utilissima*, *Dioscorea Batatas*.
- II. Cereals: oats, maize, millet, barley and Indian upland rice.
- III. Rubber plants: *Manihot Glaziovii*, *M. dichotoma*, *Funtumia elastica*, *Parthenium argentatum*.
- IV. Dye and tannin plants: *Bixa orellana*, acacias, *Carthamus tinctorius*.
- V. Spices: *Coffea liberica*, *Zingiber officinale*.
- VI. Textile plants: *Fourcroya gigantea*, *Agave Sisalana*, *Corchorus capsularis*, various cottons, *Eriodendron anfractuosum* (kapok), *Hibiscus Sabdariffa*.
- VII. Oil crops: coconut, earthnut, sesame, castor-oil.
- VIII. Sugar crops: sugarcane, Minnesota sorghum.
- IX. Fruits: *Citrus* spp. (orange, lemon, tangerine, grape-fruit), *Anona* (*muricata*, *Cherimolia*), *Mangifera indica*, olive, guava, bananas, papaw, pineapple.
- X. Narcotic plants: tobacco.

XI. Timber trees and various: *Inga dulcis*, *Poinciana regia*, *Terminalia Catappa*, tamarind, *Eucalyptus Lehmanni*, *E. citriodora*, *Cedula odorata*, *Cassia florida*, *Casuarina equisetifolia*, *C. tenuissima*, bamboos, *Parkinsonia*, mulberry.

XII. Vegetables: French beans, *Dolichos*, cowpea, soy bean, capsicum, egg-plants, onions, cabbage, chicory, beetroot, *Hibiscus esculentus*, cucumbers, etc.

XIII. Leguminous forage plants: lucerne, sulla, sainfoin.

AGRICULTURAL INSTITUTIONS

875 - The Reorganization of the Experimental Garden at Hamma, near Algiers. — *Bulletin de l'Office du Gouvernement Général de l'Algérie*, Year 20, No. 12, pp. 194-195. Algiers, June 15, 1914.

Several years ago the experimental garden at Hamma, which had been leased to a financial company in 1883, was taken over by the Algerian administration and reorganized on a rational system with a view to its better utilization. With this object two decrees were issued on June 5, 1914, the first cancelling the previous lease and approving the necessary equipment, the second defining the reorganization of the garden.

According to article 1 of the second decree, the experimental garden at Hamma is to serve the purpose of a nursery for the production and distribution of native crops and as a garden for scientific studies and the acclimatization of exotic plants.

The staff of the garden consists of administrator, head gardener, and clerk. The governing body consists of a permanent technical commission, comprising the following:

- The Director of the Botanical Department.
- The Professor of Botany.
- The Director of the Pasteur Institute.
- The Chief of the Forestry Research Station.
- The Chief of the Agricultural Department of Algiers.
- The Delegate of the Algerian Horticultural Society.

The garden collaborates with the Departments of Phytopathology, Forestry and Entomology, the Faculties of the University of Algiers, and, on advice from the technical commission, all other public services which require it. A museum of natural history for North Africa, the necessary laboratories and a small zoological park may be added, and a department of horticultural instruction will be organized for the education of working gardeners and grafters.

CROPS AND CULTIVATION.

SOIL PHYSICS, CHEMISTRY AND MICROBIOLOGY

876 - A New Method of Determining the Density and Porosity of Soil and Rocks. — TRUKA, RUDOLF (Tábor, Bohemia) in *Internationale Mitteilungen für Bodenkunde*, Vol. IV, Part 4-5, pp. 363-387. Berlin, 1914.

The writer has devised a new method for the determination of the specific gravity of soils and rocks, based on the researches of Dr. Slavik. Its novelty consists in detaching a lump of earth from the interior of a lar-

ger block without subjecting it to pressure or in any way altering its natural state. The small lump is dried at 100° to 103° C., then plunged in liquid paraffin at a temperature of 40 to 50° C., so that it becomes covered with a very thin layer of paraffin. The volume of the sample is determined by displacement of water in an apparatus specially designed by the writer, who describes it in great detail.

The method is applicable to all types of adhesive soils and the writer is continuing his studies with a view to devising a method suitable for sandy soils. An examination of the results obtained by this and other methods has led the writer to the following conclusions :

A. *Specific gravity*. — 1) If the density of a soil is to be used for determining its physical properties, a more exact method is required.

2) Those methods in which a given volume of soil is obtained by filling a standard measure, or by sedimentation in water, should be abandoned, since they do not take into account the stratification of the soil.

3) Methods involving the sampling of the soil by means of cylinders or tubes should also be abandoned, since the experimental error is too great.

4) The only method that can be recommended is one which consists in taking lumps of earth showing the natural stratification unchanged, thereby reducing the error to a minimum.

B. *Porosity*. — 1) For the porosity to be an exact indicator of the properties of the soil, it must take into account the natural stratification of the land.

2) Any disturbance of the natural lie of the soil in sampling is inadmissible, as it will lead to changes in the porosity.

3) The determination of the porosity by means of a lump of soil showing the natural stratification is the only method which gives results agreeing with practical experience.

4) Porosity cannot be considered alone in determining the value of a given soil ; other properties must be taken into account.

877 — A New Method for the Determination of Soil Acidity. — TRUOG, E. (Wisconsin, Experiment Station) in *Science*, Vol. XL, No. 1024, pp. 246-248. Garrison, N. Y. August 14, 1914.

Acid soils boiled with zinc sulphide and water liberate sulphuretted hydrogen, traces of which can be easily detected with lead acetate paper. On this basis the following method of determining soil acidity was evolved : 10 gms. of soil are placed in a 300 cc. Erlenmeyer flask with 1 gm. of calcium chloride, 0.1 gm. of zinc sulphide and 100 cc. of water; the mixture is thoroughly shaken and heated over a flame ; after the contents of the flask have boiled one minute, a strip of moistened lead acetate paper is placed over the mouth of the flask and the boiling continued two minutes more, when the paper is removed. If the soil be acid the paper will be darkened on the under side, the shade obtained varying with the degree of acidity from almost white to black, and the percentage acidity may be estimated by means of a standard colour scale.

This test is more delicate than the litmus test, is extremely simple to carry out and has proved very reliable ; in no case have alkaline soils given a positive reaction, even when they had undergone previous anaerobic fermentation. Experiments are now in progress to make the method more accurately quantitative by titrating the liberated hydrogen sulphide with iodine solution.

PERMANENT
IMPROVEMENTS.
DRAINAGE
AND
IRRIGATION

878 - The Ombrone Diversion for the Reclamation of the Plain of Grosseto, Italy. — LUIGI, LUIGI, in *Giornale del Genio Civile*, Year LII, pp. 254-260. Rome, May 31, 1914.

The Ombrone diversion in the province of Grosseto, Italy, is one of the most important hydraulic works now in course of construction.

It will be capable of conveying 21 200 cubic feet of water per second and in case of need even 24 700 cu. ft., whilst the Cavour Canal (so far the largest in Italy) conveys only 3885 cu. ft., the Ganges Canal 6710 cu. ft. feet, and the Euphrates diversion (1) (hitherto the largest in the world) 14 125 cu. ft.

The object of the Ombrone diversion is not irrigation, as in the above-mentioned schemes, but the utilization of the silt carried down by the water for reclaiming, by means of warping, the swamps which the protrusion of the river mouth has produced in the neighbourhood of Grosseto.

The flood water sometimes contains for about 24 hours as much as 10 per cent. of silt, and on the average there are six good floods every year.

In order to utilize this material to the best advantage, it is necessary to waste no time in securing the greatest quantity of water when it has its maximum load of silt and to fill all the depressions as speedily as possible ; hence the necessity of a large intake with rapidly acting sluices.

The works consist in : 1) a submergible weir across the bed of the river at the head of the canal ; 2) a head regulator or barrage ; 3) a channel between the weir and the regulator ; 4) the main canal for the flood water ; 5) distributing secondary channels ; 6) channels for draining off the clear water after the silt has been deposited ; 7) accessory works for the power plant to work the sluices and for the electric lighting of Grosseto, storehouses, bridges, etc.

The submergible weir is 502 feet long. It is a mass of concrete faced with ashlar. The vertical section of its surface is a sinusoid curve which prevents the formation of vortices. It was built in 1879 and has successfully withstood the heaviest floods.

The regulator barrage has seven openings from 15 ft. 3 in. to 17 ft. 9 in. wide and 20 ft. 7 in. high, closed by sluice gates worked by electric power, which can be completely raised or lowered, two at a time, in 8 minutes. The piers of the archways are 3 ft. 8 in. thick.

The main canal is about 180 feet wide at the bottom and is capable of conveying 21 200 cubic feet of water per second with a depth of water of 17 ft. 4 in. and a velocity of 7 ft. 8 in. per second, or 24 700 cu. ft. with a depth of 18 ft. 4 in. and a velocity of 8 ft. 4 in. These high velocities

(1) See No. 414, B. May 1914.

are necessary firstly to keep the dimensions of the canal within reasonable limits and secondly to prevent any untimely deposit of silt.

Close to the regulator two buildings have been erected, one for two groups of 40 HP oil motors which drive the dynamos and a 20 HP motor for the workshops and electric light, etc., and the other as a storehouse, workshop and dwelling house for the workmen.

At the side of the canal between the weir and the regulator there is another building with a one-arch regulator for a power channel for the electric lighting of the city of Grosseto and a grain mill. This channel conveys 176 cu. ft. of water per second.

The main diversion or warping canal is about 10 $\frac{1}{2}$ miles in length; for the first 2625 feet it is lined with masonry walls about 164 ft. apart. The rest of the canal is between embankments; it is 213 ft. wide at the water level and 178 ft. at the bottom, in which a small channel has been excavated to drain the canal when not in use, so as to prevent the breeding of mosquitoes. The canal is crossed by seven bridges and feeds the secondary distributing channels which convey the water to the various sections. Provision is also made for the drainage of the adjoining country.

It is calculated that in 24 hours 1236 million cubic feet of water can be collected to fill all the warping sections and that the passage of muddy water and discharge of clear water can be continued without interruption as long as the flood lasts.

The depth of the silt deposited by the floods is about 4 inches per year, but the swampy bottom, consisting of marine mud and peat, will subside under the weight of the silt; consequently the warping will be slow; it is, however, believed that the whole area of 12 350 acres will be completely reclaimed in about 30 years and will then provide excellent soil for farming purposes. Meanwhile the outside belt of the depression is already reclaimed and public health at Grosseto has already much improved.

The cost of the intake and canal is estimated at £ 160 000 and that of the whole work, including the drainage channels and regularization of rivers and a navigable canal, at £ 800 000.

879 - **The Composition and Value of Bat Guano.** — MILLER, C. F. (Bureau of Soils, U. S. Department of Agriculture, Washington) in *The Journal of Industrial and Engineering Chemistry*, Vol. 6, No. 8, pp. 664-665. Easton, Pa., August 1914.

MANURES
AND MANURING

The following results of a series of analyses of bat guano were obtained by the Bureau of Soils.

The notable variations of composition are due to: a) the presence of foreign matter, such as rock fragments, etc. (the Porto Rico samples were very rich in lime); b) the loss of useful constituents by washing out and by the decomposition and volatilization of nitrogen compounds.

The sample from Haiti is a pure bat guano of recent formation and practically undecomposed. It is calculated that this deposit contains about 700 tons valued at about £ 5 600, taking the price per ton as £ 8 approx., based on its chemical composition. This deposit exceeds the average in both quantity and quality.

Analyses of Bat Guano (percentage of dry matter).

Locality	Nitrogen	Phosphoric acid	Potash	Volatile matter
Carlsbad, New Mexico	4.24	2.31	1.28	—
Guadeloupe Mts., N. M.	1.77	2.68	0.41	40.0
Torreón, N. M.	10.82	1.08	1.01	—
Oregon Co., Montana.	8.10	2.06	0.58	—
San-Juan, Porto-Rico	1.00	3.40	0.21	—
" "	0.50	2.40	0.29	—
El Fondo, S. Domingo, Haiti.	11.84	4.80	1.61	—

No precise data relating to the area of bat guano deposits in the United States exist, but they are known to be very extensive.

88c - *The Solubility of the Various Constituents of Basic Slag.* — SIRET, MAURICE, and JORET, GEORGES (Yonne Agricultural Station) in *Journal d'Agriculture Pratique*, Year 78, Vol. I, No. 25, p. 78. Paris, June 18, 1914.

Besides phosphoric acid, basic slag contains other elements (magnesia, sulphur, manganese, iron, etc.), whose usefulness as soluble chemical manures has been recognized for some years.

The writers have endeavoured to find out to what extent these elements are soluble, both by Wagner's reagent and by solution in various organic acids of such concentration that the acidity of the solution is equal to that of 2 per cent. citric acid (Wagner's reagent). The method was the same as that employed in determining the citric-soluble phosphoric acid.

From their very numerous analyses, the writers have found that all the elements studied (silica, phosphoric acid, lime, magnesia, sulphur, iron and manganese) exist in a form soluble in various weak acids; the degree of solubility varies according to the fineness of the slag or to the actual solubility of the salts formed (citrates, malates, lactates, etc.).

The degree of solubility of the different elements varies as follows:

	per cent	
phosphoric acid.	24	to 87.2
lime	48.4	to 89.4
magnesia.	3.1	to 67.6
iron	10.8	to 41.4
manganese	7.7	to 39.7

Citric and malic acids have the greatest power of solution, and lactic, acetic, tartaric and oxalic acids follow in order.

In the slags studied there are few insoluble silicates. The silica is very soluble in weak acids, citric, lactic and malic dissolving about 90 per

cent. of the total. It appears that the solubility of this element varies with that of the phosphoric acid, as would be expected if these two elements are in a state of combination as silicophosphate, as many writers affirm. The solubility of iron and manganese also appears to vary in the same proportions.

In conclusion, basic slag can be considered not only as a phosphatic manure but also as a compound manure.

881 - Measures for Meeting the Shortage of Potash Manures in Great Britain. — *Leaflet of the Board of Agriculture and Fisheries*. London, August 1914.

AGRICULTURAL
BOTANY,
CHEMISTRY
AND
PHYSIOLOGY
OF PLANTS

The Board of Agriculture and Fisheries desire to draw the attention of farmers and gardeners to the need for seeking new sources of potash manures, since the existing stock is very small and no further importation is possible for the present.

The chief natural sources of potash immediately available are: 1) seaweed, and 2) weeds, prunings, hedge-clippings, brushwood, leaves and vegetable refuse generally.

Seaweed is already extensively used as a manure on the coasts, and all who have access to this source of supply should collect it in quantity. Broad weed (*Laminaria*) may be used direct as a manure; grassy weed and tangle (*Fucus*, etc.) should be dried and burnt wherever possible. A ton of fresh seaweed should yield 20 to 30 lbs. of potash, or sufficient to manure from a quarter to half an acre of potatoes.

Inland farmers and gardeners may obtain potash by burning all kinds of vegetable refuse not suitable for direct application to the soil. The percentage of potash in vegetation varies very widely; among ordinary weeds for example, thistles might yield 5 per cent. and nettles 2.5 per cent. of their weight as potash; timber contains very little potash, cordwood a considerable quantity, and brushwood still more; ordinary wood ashes might contain from 5 per cent. to 10 per cent. according to their source. Ashes from the burning of weeds, prunings, hedge-clippings, etc., may contain from 10 to 15 per cent. of potash, i. e., corresponding to an equal weight of kainit, which last spring sold at about £ 2 10s per ton.

It is absolutely essential, in the absence of full supplies of farmyard manure, that potash should be supplied to such crops as potatoes and (on light soils) turnips, and that it should be available in gardens for potatoes, carrots, parsnips, onions and many other crops.

In many districts farmers might advantageously employ unemployed labourers in the collection and burning of all vegetable refuse. The ashes should be stored in a dry place and applied in the following spring.

882 - Coloration of the Seed-Coat of Cowpeas. — MANN, ALBERT (Plant Morphologist, Bureau of Plant Industry, U. S. Dept. of Agriculture) in *Journal of Agricultural Research*, Vol. II, No. 1, pp. 33-56 + 2 figs. Washington, April 15, 1914.

This study was undertaken to determine the possible relationship between the arrangement of the various layers of pigment and the heredity of colour in the seed coat, and to verify the supposition that colours optically alike are, in some cases, different in the constitution of the pigment

and place of deposit. The subject is dealt with under the following heads: Methods of Preparation, Morphology of the Seed Coat, Pigmentation of the Basal Colour Layer, Pigmentation of the Palisade Layer, Seeds Destitute of Pigmentation, Classification of Colour Factors in Cowpeas, Classification based on Distribution and Kinds of Pigments (1. Cowpeas having no pigment in the palisade layer; 2. cowpeas having only anthocyanin in the palisade layer; 3. cowpeas having only a melanin-like pigment in the palisade layer; 4. cowpeas having both a melanin-like pigment and anthocyanin in the palisade layer).

The writer summarises the results as follows. The greatly diversified colour schemes of the different varieties of cowpeas may therefore be reduced to two factors: 1) an extremely uniform basal colour, ranging from very pale yellow to deep copper red, but found to be in all cases due to a melanin-like pigment deposited in the basal colour layer, the differences in tint being unquestionably caused by differences in quantity rather than in character of the pigment present; and 2) a superimposition upon this basal colour of variously arranged pigment areas in the palisade layer, the outer layer of the seed coat, the pigments here being of only two kinds, first, a melanin-like pigment very generally identical in colour and behaviour to that found in the basal layer, and, second, an anthocyanin pigment, either associated with this or found in separate cells.

This anthocyanin pigment may be of a red or blue colour according as the reaction is acid or alkaline, and these two colours may be found in the same cells or in separate cells. Finally, according as only one or more than one or all of these pigments are present in the palisade layer, or according as they are uniformly distributed throughout its cells or are variously localised in large or small areas of its cells, we get the remarkably diversified blotching, streaking, speckling, marbling or monochrome colorations which characterise the different varieties of cowpeas.

In cases where the seed coat is white or cream coloured, or has a certain white area, or even where there is merely a slight speckling, the palisade cells show great distortion of outline and unevenness in the cell cavity. Again, in most parti-coloured cowpeas of strongly contrasted tints, the strongly coloured areas have perfectly regular, symmetrical palisade cells, while the lighter areas are more or less strongly contorted in form and irregular in the cell cavity. In other words there is a decided correlation between the morphology of the palisade cells and the suppression of the pigments in these cells.

883 - **Palms Indigencous to Cuba.** — BECCARI, ODOARDO, in *Pomona College Journal of Economic Botany*, Vol. II. No. 2, pp. 253-276, and No. 4, pp. 351-377; Vol. III, No. 1, pp. 391-417. Claremont, California, March and December 1912; February 1913.

List and botanical description, accompanied by figures, of palms indigenous to Cuba and neighbouring islands. Twenty-five species are described, of which two belong to the family *Coccinaceae*, six to *Areceae*, and the majority of the rest to *Corypheae*. The writer concludes with an account of the mode of growth of the trunk of palms.

884 - **The Influence of Pressure on the Structure of Roots.** - MOLLARD, MARIN, in *Revue Générale de Botanique*, Vol. 25 (bis), pp. 529-538. Paris, 1914.

The roots of plants growing in soils on schist formation often penetrate between two strata and become subjected to considerable pressure, which results in malformation. The writer summarises the anatomical characters of such roots as follows:

- 1). The cells are narrower.
- 2). The living cells are only slightly deformed, whilst the older tissues, such as the wood vessels, are flattened out.
- 3). Cell division ceases beyond a certain pressure, but without the life of the cells being destroyed.
- 4). The xylem and phloem elements grow chiefly in a direction parallel to the plane of the pressure.
- 5). Differentiation of secreting canals may cease.
- 6). The fibrous tissues are largely or entirely suppressed.
- 7). The two extremities of the compressed portion of the root become hypertrophied.

These observations were made on material of *Carlina corymbosa*, *Oenanthe Crocata*, *Plantago maritima* and *Hedera Helix*.

885 - **The Aroma of Hops: Studies of the Essential Oil and its relation to Geographic Distribution of Hops.** - RABAK, FRANK (Chemical Biologist, Drug-Plant and Poisonous Plant Investigations, Bureau of Plant Industry, U. S. Department of Agriculture), in *Journal of Agricultural Research*, Vol. II, No. 2, pp. 115-159, + 14 figs. Washington, D. C., May 1914.

The writer has made determinations of the following properties: specific gravity, optical rotation, refractive index, solubility in pure or dilute alcohol, boiling point, ester value, acidity, saponification index. Comparisons have been made of hops from the United States (California, Oregon, Washington, New York) with hops from Bohemia (Saaz) from authenticated sources during four consecutive years.

The volatile oil was prepared by distillation in a current of vapour. The average yield of essential oil varies considerably for a given locality from one year to another. The specific gravity of the essential oil from different Californian hops was almost constant during the same season and varied very little from one year to another. A similar observation was made with regard to the refractive index. The averages of numerous determinations obtained during several years are given in the following table. The data relating to Californian hops are from samples from five different sources.

The writer concludes from his results that the volatile oil of hops consists chiefly of: 1) myrcene; 2) esters consisting of compounds of hepticoic (œnanthylic), octoic (or caprylic), nonoic (or pelargonic) acids in combination with myrcenol (alcohol); 3) humulene; 4) traces of free acid; 5) formaldehyde. The various essential oils examined contained different proportions of ester, myrcene and humulene. Although not much importance is attached to the two latter constituents, the variations of strength of ester are very significant in relation to the aroma.

The chief chemical and physical properties of the essential oil of hops.

Origin	Essential oil, per cent.	Specific gravity	Refractive Index at 20° C.	Volume of ess. oil, soluble in 3 vols. of alcohol at 94° C. (1909)	Index of acidity	Ester value	Index of Saponi- fication
California .	0.324	0.8326	1.4775	0.8	1.41	45.6	47.0
Oregon . . .	0.290	0.8385	1.4745	1.0	2.70	58.8	61.5
New York .	0.192	0.8554	1.4753	0.8	3.25	50.9	54.2
Washington	0.370	0.8482	1.4748	0.9	1.25	52.8	54.0
Imported .	3.310	0.8433	1.4862	0.75	2.02	23.5	25.5

Important differences in the constitution of the essential oils occur not only in hops of the same season and from different districts, but also from the same districts during several seasons. These differences appear very prominently in the curves of the chemical and physical properties. The curves of fractional distillation representing a partial quantitative separation of the principal constituents show very clearly the relation between the hops of a particular district during the different seasons. The curves of optical rotation also show this relation very clearly. Generally, the physical properties (fractionation, specific gravity, and optical rotation) show the existence of strong resemblances between the essential oils of the same type and strong differences between oils of different type.

Since the esters are the most important constituents affecting the aroma of hops, the various hops have been compared by means of the ester values of their essential oils after distillation. The curves of the strength of ester of different essential oils and their fractions show at once the different geographical distributions. All hops from countries other than North America were always deficient in esters.

The essential oils of hops from California are very similar from one year to another with regard to their physical and chemical properties. The hops from the various parts of California are very analogous and give parallel curves each year. The essential oils of hops from Oregon and Washington are very analogous, but show slight differences from those of California. The hops from New York State resemble foreign varieties with regard to essential oil, but are richer in esters. Arranged in the order of increasing strength in esters they are as follows: imported hops, Californian, Washington, New York, Oregon, the last three being almost alike.

It has not been possible to establish any relation between the ester value of the essential oil and the quality of the hops, though this value shows a distinct relation to the place of origin in every case. A bibliography of twenty-seven works is appended.

886 - **Fenugreek Seeds.** — WUNSCHERDORFF (Chief of works of the Faculty of Medicine and Pharmacy at Algiers), in *Journal de Pharmacie et de Chimie*, Year 106, 7th Series, Vol. X, No. 4, pp. 152-155. Paris, August 16, 1914.

Fenugreek seeds are exceptionally rich in nitrogen and phosphorus, the former in the form of albuminoids, the latter in the form of phytin, nucleo-albumin, and especially lecithin (1.5 to 1.7 %) which is present in greater quantity than in any other seed. The flour obtained from the decorticated seeds contains 5.81 % of nitrogen, corresponding to 36.3 % of albuminoid matter, 1.042 % of phosphoric acid, of which 0.135 % is in the form of lecithin, 0.758 % as phytin, and 0.149 % as nucleo-albumin. These seeds are therefore of high nutritive value. They were used by the ancients in recuperating the constitution and are now used by the natives of North Africa as a protection against disease, an extract being used as a febrifuge. The writer confirms their food value but doubts their medicinal value. The bitter flavour and disagreeable odour after eating are much against their use. The writer has found that this disagreeable odour is due to a diastatic action taking place during the final stage of ripening of the grain, and that it disappears on germination. Treatment with boiling alcohol and rapid drying at low temperatures destroys the odour and enables them to be preserved indefinitely in air-tight tins.

887 - **The Assimilation of Atmospheric Nitrogen by Plants.** — KÖVESSI, FRANÇOIS, in *Revue générale de Botanique*, Vol. 25 bis. (Researches in Vegetable Biology: dedicated to GASTON BONNIER by his pupils and friends on the occasion of the 25th anniversary of the foundation of the Laboratory of Plant Biology at Fontainebleau), pp. 405-415. Paris, 1914.

The writer confirms the previous conclusions concerning the utilization of the free nitrogen of the air by plants (1). Plants were grown under the two following conditions: 1) in an atmosphere without nitrogen (oxygenated); 2) in the open air. The two series gave the same reactions, showing the presence of protein in the hairs, particularly in the specialized hairs studied by JAMIESON, and by ZEMPLÉN and ROTH, who attribute to them the power of absorbing and fixing nitrogen from the air.

Various protein reactions were applied, from the results of which the writer draws the following conclusion: The presence of protein in the hairs of plants grown in a nitrogen-free atmosphere shows that it is due to cell growth and normal nutrition, and not to a direct assimilation of atmospheric nitrogen. Thus the theory of Jamieson, Zemplén and Roth, that the protein in the hairs is formed only from atmospheric nitrogen, is untenable.

888 - **Physiological Researches on the Germination of the Pollen of *Vitis vinifera*.** — GARINO CANINA, E., in *Le Stazioni Sperimentali Agrarie Italiane*, Vol. XLVII, Part 7, pp. 480-492. Modena, 1914.

From a study on the germination of vine pollen, the following conclusions have been drawn:

1) The pollen grains of the vine require an acid medium for develop-

ment, in accordance with the strongly acid reaction of the sap of this plant.

2) The most suitable medium for laboratory experiments is one containing 15 per cent. saccharose, 2 per cent. gelatin, and tartaric acid in the proportion 1 : 4000.

3) Prolonged rainy weather, by diluting the stigmatic secretion, may cause the pollen grains and tubes to burst, as is the case when germination is effected artificially in distilled water.

4) Temperatures outside the limits of 14° C. and 35° C. during the flowering period produce sterility, owing to the absence of germination below 14° C. and to the abnormal development of the pollen tube above 35° C.

5) Many of the fungicides used on vines are injurious to the pollen grains.

6). The grower should have no difficulty in choosing between a possible danger of sterility and the certainty of infection by oidium or mildew.

PLANTS BREEDING

889 - **Thirteen Years of Wheat Selection.** — HUTCHESON, T. B. (Associate Agronomist, University of Minnesota), in *The American Naturalist*, Vol. XLVIII, No. 572, pp. 459-466 + 3 tables. Lancaster, Pa., August 1914.

In 1901 the Minnesota Agricultural Experiment Station planted a number of varieties of wheat from the *polonicum*, *spelta*, *turgidum*, *durum*, and *vulgare* types. Six of these varieties (one each of *turgidum*, *vulgare*, *spelta* and *durum*, and two of *polonicum*) have been grown continuously and selected by the centgener method. This method consists in planting one hundred selected kernels from each plant, at equal depths and at equal distances apart in separate plots. Careful notes are taken of the plants of each centgener, and at harvest five or more of the highest yielding plants are selected, from which the seeds for planting the next year are taken. From these five best plants, from five to ten of the best heads are selected and thrashed together. One hundred of the largest and plumpest kernels are selected and planted in the centgener test next year. This operation is continued from year to year.

In 1908, an experiment was planned with the object of developing a strain of wheat which would have a minimum amount of culm exposed between the base of the spike and the upper leaf sheath, *i. e.* a short-necked variety of wheat. The ultimate purpose of this was to reduce the area of the stem exposed to the black stem rust, which does not attack that portion of the stem enclosed in the leaf-sheath. For this work individual plants were selected which had short necks and the seeds from these were planted in separate centgeners. A continuous selection of short-necked plants was made during the succeeding years.

Each centgener was started from a single head in 1901, and since wheat is normally self-fertilised, these heads have bred true to type ever since. Thirteen years of selection in one pure line is the longest period of continuous selection yet reported for a self-fertilised plant, thus making these data of considerable importance.

Tables are given showing the results of selection for increased yield (1901-1913), for increased height (1901-1913) and for short neck (1909-1913). From the data presented in these tables it is evident that there has been no permanent gain for these thirteen years of selection, either in yield per plant, height of plant, or shortening of neck-length. Only the expected seasonal variations occur, which were the same, with regard to production, as in the continuous open field experiments without selection.

A comparison of the yield of each variety for the first five years of the test with that of the last five years is shown in the accompanying table, which shows that there is no significant difference in yield for these two periods.

Variety.	First 5-year period.		Last 5-year period.	
	Height.	Yield.	Height.	Yield.
	in.	gms.	in.	gms.
Hedgerow (<i>turgidum</i>)	41.6	2.67	38.4	2.34
Russian (<i>vulgare</i>)	38.0	1.99	35.4	2.18
Spelt (<i>spelta</i>)	40.0	2.51	39.2	2.40
Kamouka (<i>durum</i>)	36.4	2.01	35.8	1.97
Polish I (<i>polonicum</i>)	39.9	1.54	37.4	1.61
Polish II (")	33.4	1.62	33.4	1.31
Average	38.2	2.06	36.5	1.97

From the practical breeder's standpoint permanent improvement in pure lines of small grain, if possible, is certainly not rapid or apt to be very marked. It is probable that much more rapid progress could be made by segregating pure lines from mixed populations and combining the desirable characters of these lines by hybridisation.

890 - Note on the Selection of Maize in Cambodia. — DE FLACOURT, MARTIN (Chief of Agricultural and Commercial Service in Cambodia), in *Bulletin économique de l'Indo-Chine*, Year 17, No. 107, pp. 215-218. Hanoi-Haiphong, March-April, 1914.

Maize is extensively grown in Cambodia chiefly as food for the inhabitants, and it generally precedes rice in the rotation. There are two chief varieties: one with orange yellow grains, the other with milky white grains, the vegetative periods being 90 and 105 days respectively.

The writer proposes selecting local varieties with a view to improving their earliness. These two varieties show considerable variation as regards coloration of the grains and number of secondary tillers, and sometimes show pale green or white striations on the stem and leaves. These variations cannot be explained by hybridisation alone, but would seem to indicate a tendency to mutation amongst some individual plants.

In these experiments the writer found that the variation was increased by exposing the ripe ears freed from the sheath for several days, thus

causing a cracking of the grains similar to that produced by the mechanical process employed by BLARINGHEM. The present pedigrees are too short to enable conclusions to be drawn.

It was also found that the secondary shoots, in many cases, flower at the same time as the main shoot, and though some 20 to 23 days younger than the latter, they ripen their grains at the same time, thus having a shorter vegetative period. The inflorescences of the secondary shoots are of three different forms: 1) they are exclusively unisexual, 2) the female inflorescence is normal in type but surrounded at its base by small ears, 3) the terminal panicle carries both male and female flowers. Seed is selected only from the best grains produced by the normal inflorescences of the secondary shoots, and it is found that the earliness of maturity of these seeds is inherited by the descendants.

Plants were also raised from seeds from the abnormal inflorescences of the last two types; they produced perfectly normal male and female inflorescences with the same degree of earliness of maturity.

AGRICULTURAL SEEDS

891 - Innovation in the Danish Trade in Seeds of Root Crops. — *From a Communication by H. HELWEG, Director of Experiments at Copenhagen.*

In Denmark the State has for a number of years carried out trials of root crops, for which any Danish seed breeder can enter his strains of seed. According to the results the strains are divided into three classes. The names of the breeders of the first class seeds are published. Owing to the great demand for seeds on the part of the trade, prices rise very high and this stimulates the breeders to further exertions. Thus 10 s a pound is now paid for pedigree mangold seeds and 20 s a pound for turnip and swede seeds.

This cooperation of State, breeder and seedsmen has already led to an increase in the yield of Danish root crops.

Of late years the practice has been introduced of selling seeds of root crops with a guarantee as to their quality, as has long been done for grass seeds.

For both root-crop seeds and grass seeds the value of the crop depends upon the genuineness of the seed, but with this difference, that the genuineness of grass seed can be recognized by examination, while the quality and strain of root-crop seeds cannot; the analysis of the latter carried out by the seed control stations has therefore little value, whereas in the case of grass seeds it is so useful that it has become customary to base the price upon it. It is further to be noted that the analysis of a parcel of grass seeds can be controlled by another examination in spring, while the quality of the root-crop seeds can only be checked in the autumn by an expert examination of the roots in the field in which the seed was sown in the spring.

Complaints as to the quality of the seeds sown in spring are allowed up to the 15th of October of the same year.

In the spring of 1912 the guarantee for genuineness of Danish root-crop seeds was introduced into the home trade and in 1913 into the foreign trade. Not all the wholesale seedsmen have adopted the guarantee system

in their transactions, but they must henceforward mention it expressly on their business papers, etc.

For the settlement of possible disputes concerning the guarantee, an official (of the Weights and Measures Bureau) takes an average sample from the seeds sold under such guarantee and sends it to the State Commissioner for root crops, who has all the samples sent in sown in a control field recognized by the State. Complaints from abroad are to be brought before the Maritime and Commercial Tribunal of Copenhagen, which appoints two or three experts to examine the roots produced in the above field by the seed in question, and if the seeds delivered do not correspond to their description the amount of compensation due is determined on the result of the test made in the experiment field.

892 - **The Longevity of Some Common Seeds.** — EASTHAM, ALFRED (Chief Seed Analyst, Department of Agriculture of Canada, Seed Branch) in *The Agricultural Gazette of Canada*, Vol. I, No. 7, pp. 544-546. Ottawa, July 1914.

Researches on the longevity of seeds were begun in 1903 and will be continued until the vitality of the seeds has been entirely lost. Seeds of

	Germinating capacity after:			
	1 yr.	5 yrs.	7 yrs.	10 yrs.
<i>Timothy:</i>				
Average of 12 samples harvested in 1902	97	90	83	56
Average of 12 samples harvested in 1903	93	90	85	52
<i>Red clover:</i>				
Average of 12 samples harvested in 1902	97	76	61	44
Average of 12 samples harvested in 1903	96	75	68	43
<i>Alsike clover:</i>				
Average of 12 samples harvested in 1902	93	79	66	45
Average of 12 samples harvested in 1903	93	81	72	45
<i>Oats:</i>				
Average of 53 samples harvested in 1900 (1)	94	95	93.5	91
Average of 64 samples harvested in 1901	98	97	96	—
Average of 63 samples harvested in 1902	95	97	97	—

(1) From the various provinces of Canada.

high germinative capacity were chosen and stored in sealed boxes in the Seed Branch Laboratory of the Department of Agriculture. The results are shown in the accompanying table.

CEREAL
AND PULSE
CROPS

893 - The Influence of External Physical Agents on the Germination of Wheat.

— 1. LOYER, HENRI. — 2. RIVIÈRE, C. — *Bulletin de la Société Nationale d'Acclimatation de France*, Year 61, No. 14, pp. 447-456. Paris, July 15, 1914.

1. — The writer states that the influence of physical agents on germination requires a more precise investigation and that many problems remain to be solved in regard to aeration, moisture and temperature. For example: the limits of rarefaction and pressure between which germination is possible, the gradual reduction of germinative power, the maximum and minimum quantities of water favourable to germination, and the correlation of data relating to the duration of germination in relation to temperature. The writer points out that the temperature data obtained by the methods of RÉAUMUR, DE GASPARIN, DE CANDOLLE, TISSERAND are not concordant, since they show great differences for the same vegetative period of the same plant. He proposes a method of his own which appears to give better results.

The sum-totals of the daily means of the squares of the hourly temperatures always give the same result for the germinative period of the same plant. In the case of wheat, for example, the number always approximates to 1500, provided that the squares of temperatures above 20° C. are reckoned as 400 and that only the temperatures between 0° and 20° are included in the actual values.

The writer considers that these generalisations are common to all plants and intends to verify them in cases other than wheat.

II. — The following comments have been made by M. C. RIVIÈRE.

These experiments have the advantage of being carried out under precisely controlled conditions, the same plant being used throughout, since each variety requires certain variable meteorological conditions to complete its development. The results are interesting, but some indication, however approximate, should be given of the meteorological conditions affecting germination, such as soil temperature, illumination and humidity.

Rise of temperature, for example, does not always coincide with increased illumination, and the more rapid development of wheat in northern Europe near the arctic regions is due more to increased illumination, than to the temperature. Thus, the intensity of light during the night should be taken into account. Further, what method of computation can take into account all meteorological influences?

There are also meteorological influences which are difficult to define and determine. Since our determinations of meteorological conditions are as yet only rudimentary compared with the complexity of the subject, all conclusions should be considered as arbitrary only. The method of M. LOYER will tend to narrow down the problem. It is possible to determine the number of calories necessary for the germination of wheat by experiments *in vitro* with temperatures controlled and automatically recorded, but the results thus obtained are so far removed

from natural conditions that they are useless to determine the actual meteorological conditions conducive to good or bad germination. This is the problem which still awaits solution.

894 - **Studies on the Pollination of Lucerne in its Relation to Seed Production.** — PIPER, C. V.; EVANS, MORGAN W.; MCKEE, ROLAND, and MORSE, W. J., in *Bulletin of the U. S. Department of Agriculture*, No. 75, pp. 32 + 1 fig. Washington, April 8, 1914.

FORAGE
CROPS.
MEADOWS
AND PASTURES

In the regions of the United States where lucerne is grown for seed, the yield varies considerably from one season to another. Thus, in Milk Valley, Montana, in some seasons the yield has reached 10 to 12 bus. per acre, whilst in others it has been practically nil.

With a view to finding the cause of this difficulty the Department of Agriculture in 1906 undertook a series of experiments at several stations. The problem was found to be a most complex one, depending not only on the abundance of insects for pollination, but also on the climatic conditions. Under certain climatic conditions autogamous pollination is an uncertain factor from one season to another and among different individual plants. The factors or conditions favouring the production of seed vary during the season, as is seen from the occurrence of pods amongst the mature plants. On several occasions, especially during the first cut, it has been seen that artificial pollination by agitation of the stamens does not result in fructification.

The writers review the work of previous authorities on the structure and pollination of the flower of lucerne, showing conclusions at variance with each other. Only in some cases are direct attempts made to determine the relation between pollination and the quantity of seed harvested. The prevailing opinion is that pollination by insects is of vital importance, and that if they are not present in sufficient numbers, the yield of seed is reduced. The importance of the climatic conditions is generally recognized, and it is pointed out that commercial seed is produced in regions with a semi-arid climate, at least during the ripening period.

The flowers of lucerne may be pollinated at any time from the opening of the flower to the fall of the petals. Pollination generally takes place after the release of the staminal tube, which is effected by a special mechanism. The staminal tube is held by two opposite lateral protuberances inside the keel. Heavy insects such as the bumble bee are able to press the sides of the keel apart, thus liberating the staminal tube. Generally, however, the operation is effected by the insect inserting its proboscis between the posterior edges of the keel. More often the two posterior appendages of the wings, which meet above the staminal tube, are displaced, thus causing an indirect distension of the keel. The presence of this spring-like mechanism has been observed in twenty species of *Medicago*, also in *Alysicarpus*, *Trigonella*, *Indigofera* and *Genista*. The writers have not been able to confirm BURKILL's theory, that the release of the staminal tube causes a rupture of the stigmatic cells and promotes fertilization. Liberating the staminal tube by artificial means, so as not to stimulate or rupture the stigmatic cells by contact, gives as good results as natural pollination.

Flowers which are artificially exploded and thereby self-fertilized produce an abundant crop of seeds. In a series of experiments on 77 plants conducted in 7 different places, 9074 flowers produced 2784 fruits (or 30.66 per cent.) when mechanically self-fertilized, whilst 8939 flowers on the same plants fertilized under natural conditions yielded 1499 fruits (or 16.76 per cent.). The fruits from flowers artificially exploded contained an average of 1.72 seeds each, whilst the fruits of flowers naturally fertilized contained 2.22 seeds.

Cross-pollination among flowers of the same plant is not more productive of seeds than self-fertilization, but pollen from other plants increases the proportion of fruits and the number of seeds per fruit. There is no considerable difference between the pollen of like or of dissimilar varieties.

The explosion of lucerne flowers normally takes place automatically, but may be caused by insects or other agents. Flowers which fail to open rarely produce fruits and seeds. Two plants were observed at Chinook, Mont., in 1909; one had 57 flowers, of which 33 exploded automatically and set 21 fruits; the other had 64 flowers, of which 36 exploded automatically and set 16 fruits. The percentages of fruits formed from these flowers were therefore 37 and 25 respectively. These figures are as high as those obtained under natural conditions in the fields. In a similar experiment conducted at Pullman, Wash., in 1910, only 21 out of 775 flowers left to themselves produced seed, or 2.7 per cent., against 13.15 per cent. in the open.

There is considerable variation in the rapidity with which the flowers of lucerne explode automatically or by means of exterior agents, and in their subsequent fructification. The number of fruits is not proportional to the number of flowers, since the largest inflorescences are less fertile than the smaller ones.

Automatic fertilization of the flowers takes place more frequently during warm sunny weather and is influenced considerably by the humidity. Pollination can be immediately effected by placing the open flowers at the focus of a converging lens or by exposing them to the sun on a warm day. Insects are the natural agents of cross-fertilization of lucerne, but good yields of seed can be obtained in places where they are rare. Bumble-bees and *Megachiles* are the most effective insects for effecting the dispersal of the pollen. Bees collect honey from these flowers, but effect pollination in only a few cases. Nocturnal insects are of negligible importance. There is no evidence to show that butterflies are able to effect pollination; wind and rain are of slight importance.

Automatic explosion of the flower and consequent self-pollination is as effective in producing seed as insect pollinizers, at least in the Western States. This conclusion agrees with the observation that excellent yields of seed are obtained in regions where bumble-bees and other suitable insects are rare.

895 - **Alfalfa in the United States.** — BROOKS, WILLIAM P., in *Massachusetts Agricultural Experiment Station, Bulletin* No. 154, pp. 147-171 + 2 tables. Amherst, Mass., June 1914.

This is a bulletin of instruction and propaganda intended for practical farmers. Part of the directions are based upon the experimental results obtained either by the writer at the Amherst Agricultural Experiment Station or by thirty-three farmers in different parts of the State.

Alfalfa is now successfully grown in most parts of the United States and in a few parts of Canada. It is popularly supposed that alfalfa is much superior in nutritive value to clovers, but so far as can be determined by chemical analyses made at the Amherst Station and determinations of digestibility made there and in other stations, this does not appear to be the case, as may be seen from the following tables :

TABLE I. — *Composition of Clover and Alfalfa Hays.*

	Water %	Ash %	% Protein	Fibre %	Nitrogen free extract %	Fat %
Alfalfa hay	13.24	6.38	13.98	28.48	34.70	1.40
Alsike clover hay	15.00	9.70	14.00	23.10	36.10	2.10
Medium red clover hay	15.00	9.70	13.30	24.30	37.20	2.50

TABLE II. — *Digestible Nutrients and Energy Values (*).*

	Protein (lbs. in 100)	Fibre (lbs. in 100)	N-free extract (lbs. in 100)	Fat (lbs. in 100)	Net energy value (Therms)
Alfalfa hay	10.2	13.9	24.4	0.5	34.9
Alsike clover hay	9.2	11.6	23.8	0.8	34.6
Medium red clover hay	7.7	13.1	24.2	1.4	35.6

(*) Based upon average results in the United States.

The writer does not recommend the direct application of manure in preparing the soil for alfalfa, but advises instead the free use of it on the preceding crops. Sometimes, however, the direct application of potash, lime and phosphatic fertilizers may be advisable. In the writer's experiments potash in the form of sulphate appeared much superior to potash in the form of chloride.

Some varieties of alfalfa introduced from Siberia by the South Dakota Experiment Station have not yet been sufficiently tested. The best seeds of common alfalfa grown in The United States are those from the northern districts ; Grimm's alfalfa is a selected strain which originated in

Minnesota and is noted for hardiness and productiveness (1). In some experiments conducted by the writer with Grimm and common alfalfa, the former yielded an average produce in 3 cuts per year for two years, of 3.982 tons per acre against 3.261 tons of the latter, or a difference of about 22 per cent. in favour of the Grimm.

The variegated alfalfa is said to be a cross between common alfalfa and yellow lucerne. This variety is said to be more hardy than ordinary alfalfa and adapted to poorer soils: it has, however, a tendency to decumbent growth, and a lower feeding value.

Hitherto few diseases have proved troublesome to alfalfa in Massachusetts; the only important ones are leaf-spot (*Pseudopeziza Medicaginis*) and dodder.

Two experiments in inoculation with "Farmogerm" culture (prepared by the Earp-Thomas Farmogerm Co., Bloomfield, N. J.) were made and gave good results on land which was put under lucerne for the first time.

CROPS
YIELDING OILS,
DYES AND
TANNINS

896 - **Methods of Propagation of Olives** (2). — CAMPBELL, C., in *Le Stazioni Sperimentali Agrarie Italiane*, Vol. XLVII, Part 4, pp. 297-307. Modena, 1914.

The writer draws the attention of olive growers to the importance of the methods of propagation. The seeds of the wild varieties of olive have the highest germinating power, but the growth of cuttings (as shown by the writer's experiments) is more vigorous in the case of cultivated varieties and improves as the number of asexual generations increases.

Of the various methods of asexual reproduction, *e.g.* by cuttings, from "ovoli" (3) and by grafting, the last-named method is destined to be of the greatest importance in the future. Reproduction from seed is seldom practised, since the number of seeds which germinate is small, and each stock requires subsequent grafting. The writer remarks that it is possible to improve the germination of the seeds, which is more vigorous in the hardier and semi-wild varieties. The seeds from trees grown directly from seeds are more vigorous in germination than seeds obtained from grafted trees. New varieties obtained in this way, using seeds of the best varieties, will yield seeds with a higher percentage of germination. Since it is necessary to choose vigorous plants as stocks, especially for arid and infertile soils, the writer recommends the sowing of seeds of cultivated varieties so as to produce stocks more suitable for receiving the grafts of their own varieties or others of similar vigour. It will then be possible to undertake on an extensive scale the selection of different varieties, at the same time obtaining useful stocks.

(1) See No. 2106, *B.* July 1911.

(2) See Nos. 2668 and 2669, *B.* Aug.-Sept.-Oct. 1911; No. 1046, *B.* Sept. 1913.

(3) Excrecences formed at the bottom of the trunk; these are cut off and planted in the ground like cuttings.

long, which damage the fruits and branches, thus reducing the value of the next year's crop. The writer has introduced a sort of wooden comb, used in some parts of Italy, which enables the fruits to be collected with less damage to the trees.

In the case of the very bushy trees growing in an almost natural condition in the mountains, the first thing to be done is a good thinning. The harvesting of the fruit should be regulated for each district, as the growers are apt to start picking too early, with the result that an inferior oil is produced.

There are two varieties of olives in Kabylia, the Chembal and the Rougette, the latter being more common. The western slope of the Djurjura is favoured by abundant rain, averaging 45 to 50 inches per annum. These conditions are very favourable to the future welfare of the industry in this region. The adoption of modern rational methods would result in immediate improvements and a yearly crop instead of one every other year.

899 - **The Aleurites of Tonking.** — LEMARÉ, CH., in *Bulletin économique de l'Indo-Chine*, Year 17, No. 107, pp. 144-150. Hanoi-Haiphong, March-April, 1914.

The writer gives a description and botanical analysis of the species of *Aleurites* of Tonking, with references to others from China and Japan. "Cây-trau" of Tonking was first described as *A. cordata* Muel. Arg.

Eberhardt recorded *A. Fordii* Hemsl. as occurring in the remote province of Tonking. The only species found by the writer in the Delta and forest regions are *A. triloba* Forst. (*A. moluccana* Willd.) or "cây-lai", and *A. montana* Wils. or "cây-trau", of the latter of which he gives a botanical description.

E. H. Wilson (*Bulletin of the Imperial Institute*, Vol. XI, No. 3), mentioned that the species which yield a drying oil used for waterproofing objects, varnish, linoleum and rubber substitutes, etc., occur on the continent, while the Japanese species, *A. cordata* Muel. Arg., yields a burning oil.

Enormous quantities of drying oil are exported to Europe and America. Thus, in 1900, more than 330 328 pikuls (about 44 million lbs.) of oil obtained from *A. Fordii* were exported from Hankow, valued at 2 559 344 Haikwan taels (about £ 320 000), and in 1910 as much as 757 959 pikuls (about 100 million lbs.) valued at 6 449 421 taels (or £800 000). The exports from Outcheon during the same period increased from 24 469 pikuls (or 3 million lbs.) of oil from *A. montana*, valued at 146 813 taels (or £19 000), to 52 106 pikuls (7 million lbs.)

A. montana Wils. is limited to the subtropical regions in the south-west of China, from Fukien to Annam. *A. Fordii* Hemsl., which yields more than $\frac{9}{10}$ of the total production of oil, belongs to the warm temperate regions of the Yangtse basin. *A. montana* is much more productive in Fukien than in Tonking, where the writer suggests improvement of the variety by selection. He also recommends experiments with *A. Fordii* on the high plateaus of Tonking, as this species is more productive and the fruits are devoid of a ligneous seed-coat.

900 — **The Cultivation of the Sugarcane in the South of Spain.** — *Royal Botanic Gardens, Kew, Bulletin of Miscellaneous Information*, No. 4, pp. 147-150. London, 1914.

SUGAR CROPS

This article is based on information received from the British Consul at Malaga.

Sugarcane is cultivated in the sheltered valleys between Estepona and Adra. The most profitable varieties are: Blanca, sometimes called Americana, imported by the Arabs; Marada (violet) and Negra (black), probably the same variety: Negra is said to have been imported from Cuba; Canna cristalline, larger than the preceding but less rich in sugar; Striée, of inferior quality; Algarrobena, now almost entirely abandoned.

The preparation of the land consists in heavy manuring and careful cultivation, breaking of clods, levelling, preparation of furrows 35 inches wide and about 8 inches deep, for the planting of the sprouted cuttings in March and April. They are planted in 3 lines so that the cuttings of one line alternate with those of the adjacent lines. They are covered with a light layer of soil and gradually earthed up as they grow until the ground is level again. The land is kept free from weeds and in July or August guano or chemical manures are applied followed by irrigation for 15 to 20 days until harvest. The plantation is renewed every 7 to 8 years or 10 to 12 years. The use of a complete chemical manure has become very widespread of late years, as much as 1350 lbs. per acre being applied once or twice during the season.

The average yield is 20 tons p. acre and the average sugar content for the district is 14 % and at Adra only 8 %.

901 — **Sugar-Beet Experiments in Ireland.** — *Department of Agriculture and Technical Instruction for Ireland, Journal*, Vol. XIV, No. 3, pp. 471-482 + 4 figs. Dublin April 1914.

In 1911 the Department of Agriculture and Technical Instruction for Ireland commenced a series of sugar-beet experiments with a view: 1) to comparing the relative yields and quality of roots grown close together in rows on the flat in accordance with continental practice, and of those grown wider apart on drills or ridges, so that after-cultivation was facilitated; and 2) to affording information as to the yields of this crop in the state in which it is purchased by sugar factories, *i. e.*, of roots properly topped and cleaned.

In the 1911 experiments the farmers reported very adversely on the systems of growing sugar-beet on the flat, because it was more costly and the crop more difficult to lift than when the beet was grown on drills. In order to ascertain whether the requirements of a sugar factory for roots grown almost entirely below the surface of the soil could be met by cultivating the crop on moulded-up drills, a third plot cultivated in this manner was included in the trials in 1912. Furthermore, in 1912 half of each plot was top-dressed with nitrate of soda. The experiments in 1912 were conducted at twelve centres in eleven counties.

In 1913 the experiments of 1912 were repeated: a) on drills 27 inches wide; b) on drills 27 inches wide — the crop being moulded up after hoeing;

c) in rows 18 inches apart on the flat; d) with and without nitrate of soda at the rate of 1 $\frac{1}{2}$ cwt. per acre.

The area of each plot was one-tenth statute acre: the variety of sugar-beet used was Klein-Wanzleben Original Z.

The average yields of the three seasons 1911-13 (30 experiments in all) were as follows:

Ordinary drills:

Gross weight of roots	15 tons 9 cwt. per acre
Factory weight of roots	11 " 1 " "
Sugar content	17 per cent.

On the flat:

Gross weight of roots	16 tons 12 cwt. per acre
Factory weight of roots	13 " 2 " "
Sugar content	17.5 per cent.

From the above it is evident that the better crop in point of yield and also of sugar content was that cultivated on the flat, and that, moreover, the superiority of the roots on the flat would, at a price of £1 per ton on the farm, more than recoup the extra cost of labour involved in this method of cultivation.

The average yields in 1912 and 1913 are shown in the following table:

Plots	Average annual yield of roots per acre		Ratio of factory weight to gross weight as percentage	Average sugar content, per cent.	Average coefficient of purity (apparent)
	Gross weight	Factory weight			
	tons cwt.	tons cwt.			
Ordinary drills:					
a) Without nitrate of soda	13 6	9 8	68.1	16.5	89.45
b) With " "	15 1	10 3	67.4	16.1	89.24
Moulded-up drills:					
a) Without nitrate . . .	14 1	10 3	72.0	16.3	89.42
b) With " . .	15 11	11 4	72.0	16.2	89.55
On the flat:					
a) Without nitrate . . .	14 14	10 17	73.8	17.0	89.60
b) With " . . .	16 10	12 1	73.0	16.5	89.28

From the above table it will be seen that, on the average of the two seasons, the flat plots *a* and *b* produced yields (factory weight) only 14 and 17 cwt. respectively per acre higher than the moulded-up drill plots *a* and *b*, and that the sugar content of the roots on the former plots was only 0.7 per cent. and 0.3 per cent. respectively higher than that of the roots on the latter. These increments in yield and sugar content would by

no means be sufficient to compensate for the extra outlay in labour on the flat plots. It may therefore be inferred that of the three methods of cultivation that of moulding up ordinary drills is best adapted to Irish conditions.

It will be noticed also in the above table that the average increases in yield (factory weight) due to the application of nitrate of soda were as follows :

On ordinary drills	15 cwt. per acre
On moulded-up drills	21 " " "
On the flat	24 " " "

and that, on the average, the use of nitrate of soda slightly reduced the sugar content of the roots (the reductions being 0.4, 0.1 and 0.5 per cent. respectively). Nitrate of soda had little, though varying, effect on the purity of the juice.

From the foregoing it would appear that the application of nitrate of soda to sugar-beet would not prove remunerative on fields manured as the experiment plots of 1912-13 had been. Some of them had 15 tons of farm-yard manure to the acre and 1 cwt. sulphate of ammonia, 3 cwt. of superphosphate and 6 cwt. of kainit, and others only chemicals, namely 1 $\frac{1}{2}$ cwt. sulphate of ammonia, 4 $\frac{1}{2}$ cwt. superphosphate and 6 cwt. kainit.

In some localities the sugar-beet plots were grown alongside mangolds with a view to comparing the relative yields. The general averages of nine experiments in the three years 1911-13, the yields of the best plots being taken, were the following :

Sugar-beets (gross weight) . .	17 tons 9 cwt. per acre
" (factory weight) .	13 " 10 " "
Mangolds	28 " 18 " "

The average yield of mangolds at the same time was 19 tons 3 cwt. per acre. This shows also that the farmers who carried out these sugar-beet experiments were among the best. The inference to be drawn from these facts is that, even when cultivated in the best manner, the factory weight of a sugar-beet crop in Ireland cannot be expected to exceed about half the yield of a well-managed crop of mangolds.

902 - *Coffea excelsa* and its Cultivation. — CHEVALIER, AUG., in *Journal d'Agriculture Tropicale*, Year 14, No. 157, pp. 193-196. Paris, July 31, 1914.

The writer discovered this species of coffee in Central Africa and distributed seeds to several experiment stations, including those in Tonking, Java, French Guinea and the Belgian Congo.

Native climate. — *C. excelsa* is found in the wild state at altitudes of 2 200 ft. in a climate which is dry for six months of the year and has a rainfall of at least 40 inches during the remaining six months. The summer temperature is tropical, whilst in December and January it falls below 10° C. at night. This type of climate occurs in a number of countries. It has been shown that this species succeeds well in equatorial regions, so that its cultivation is possible over wide areas.

STIMULANT,
AROMATIC,
NARCOTIC,
AND MEDICINAL
CROPS

Quality. — The coffee obtained from Central Africa showed a satisfactory strength in caffeine, and though somewhat bitter it had an excellent flavour.

Introduction in Tonking and Java. — In Tonking its growth has been remarkable and entirely free from insect and fungoid pests. The bean is small and uniform in size and it is hoped to sell it in competition with Arabian coffee blended with Mocha. Numerous specimens have been planted in Java in the Experiment Station at Bangilan near Malang and in the Tjikeumeuth Garden near Buitenzorg. Field cultivation has also been begun in the Dutch East Indies.

Selection. — This species is being improved by M. P. J. S. Cramer. It shows variation in almost all its botanical characters. In appearance it is less luxuriant than *C. liberica*, though it is hardier and earlier.

Cultivation. — This species is particularly robust in Java. It commences to flower in the second year and yields a crop of berries in the third year. The trees should be planted at least 12 ft. apart each way. Each tree is planted in the centre of a square plot cultivated and made to slope in the opposite direction to the general slope of the land and forming a hollow at the lower end, so as to prevent erosion of the surface soil. Young plants of "lamtoro" (*Leucaena glauca*) are planted on the border of each square and periodically pruned so as to prevent the growth of old shoots. Stumps of *Leucaena* 16 inches high are planted at the four corners of the squares at the same time as the coffee plants. They are allowed to grow freely until the fifth year, when they are cut down; as the coffee plants now cover the ground the *Leucaena* along the borders of the squares and some of those at the angles are removed so as not to shade the coffee too much.

Yields. — At Bangilan an annual yield of 6r6 lbs. per acre or about 3 lbs. per tree has been obtained. M. Cramer mentions the plantation at Kedatong (South Sumatra) where 54 plants of *C. excelsa* of 4 to 5 years growth yielded 7 lbs. per tree.

Market Value. — The value of the coffee approaches that of Liberian coffee and according to M. Boom it amounts to about £ 20 per acre. The beans require particular care since they are enclosed within a thin skin which must be completely removed before the highest prices can be obtained. Unfortunately only a small supply of the best strains exists and it is only at Bangilan that a uniform collection has been seen by the writer.

903 — *Studies on the Fertilization of Hops.* — TOURNOIS, JULIEN, in *Annales des Sciences Naturelles, Botanique*, Vol. XIX, No. 2 and 3, pp. 49-491 + 5 plates. Paris, June 1914.

Investigations of the various phenomena in the sexual reproduction of *Humulus Lupulus* and *H. japonicus*.

I. *Appearance of flowers and differentiation of the sexual organs.* — The time of flowering depends strictly on external factors; changes, for example of illumination, may cause considerable variation in the duration of the vegetative period.

The species of *Humulus* are generally dioecious, though apparently monoecious individuals occasionally appear. The transformation of dioecious plants is brought about by particular conditions, especially those

which diminish the transpiration of plants, or tend to lower the osmotic pressure. It appears that a lowering of the osmotic pressure of male plants may determine the appearance of female organs or flowers and that an increase of osmotic pressure in female plants may provoke, though more rarely, the development of male organs or flowers.

II. *Fertilization and formation of the embryo.* — The ovule of the common hop may be fertilized by foreign pollen, such as that of hemp and of Japanese hop, but in these cases the resulting seeds contain only irregular abortive embryos.

III. *Formation and constitution of the fruit or cone of the common hop.* — Fertilization is not essential to the development of the cones, but it stimulates their growth. The various morphological characters of the cone which form the basis of classification of hops, are liable to variation under different conditions and are of no more value than vegetative characters in determining the varieties. Consequently the species *H. Lupulus* is to be considered homogeneous, notwithstanding the innumerable varieties of cultivated hops that have been described.

This monograph comprises 7 chapters and contains a very extensive bibliography. It concludes with generalizations concerning the determination of sex and the phenomena following pollination of the common hop with pollen from very different species. The following information on the different varieties of cultivated common hop is taken from Chapters VI and VII.

The influence of fertilization on the development of the cones is seen in their more rapid growth and greater size. The yield, excluding seeds, is doubled. The bracts of unfertilized cones are more adherent and by remaining intact during manipulation they retain the lupulin to a greater extent, whilst the fertile cones readily drop their bracts with a view to seed dispersal. It is generally believed that fertilization results in a lowering of lupulin content. The writer, however, is of opinion that the number of glands will remain the same in both types of cone and that only reduction in the relative number of glands owing to the increase in surface area of the bracts would account for the loss of strength. The only advantage, but a very important one from a commercial point of view, is the increased yield of cones after fertilization. The chief disadvantages are: greater fragility of the cones and loss of lupulin, and perhaps also reduction in strength of lupulin.

In Belgium and America, and to some extent in England, it is the custom to plant one male hop for every two or three hundred female plants, whilst in Germany, Bohemia, the East of France and Burgundy all male hops are carefully destroyed and often the local authorities forbid their cultivation. It will only be of advantage to the grower to plant male hops in his fields so long as the increased crops are not compensated for by a lower price for the dried hops.

Male hops should be planted in countries where a cool and damp climate retards the more complete utilization of the plant reserves and where

the growth of the cones is retarded by unfavourable conditions, such as extreme drought or attacks of aphids.

In reviewing the characters of the different varieties, it is only possible to compare specimens of the same variety from different districts. The characters of the cone are as follows: aroma, the character most considered by the brewers, but which has not yet been put on a proper scientific basis: shape of the cones, which varies on the same plant: percentage of seeds, indicating the extent of fertilization: the shape of the bracts, biometric measurements of which might form a suitable basis for classification; the presence of leaves in the cones, an anomaly which appears frequently in certain varieties and which occurs in other varieties in certain favourable seasons. The varieties in which this abnormality appears most frequently yield products of good quality, but are less productive, and when the character is too pronounced there is an excess of material devoid of lupulin, which may even import an inferior taste to the beer.

Other characters which are noted are: the productivity, depending chiefly on the cultivation; the degree of precocity, depending on illumination and general climatic conditions; the colour of the stems and shoots, which does not appear to be a fixed specific character.

None of the characters studied appear to be hereditary and they are of no use in defining species or varieties. Each of the cultivated forms appears to correspond to a single individual or to a small number of individuals divided into innumerable parts by means of setts. It is therefore concluded that the species *Humulus Lupulus* is very homogeneous and that the various cultivated forms (of which BRAUNGART has enumerated 200 from all parts of the world) are only individuals with slight differences.

904 - **Essential Oil of *Ocimum pilosum* Roxb.** — BHADURI KSHITIBHUSAN, in *The Journal of the American Chemical Society*, Vol. XXXVI, No. 8, pp. 1772-1773. Washington, D. C., August 1914.

The essential oil is found in every part of the plant including the seeds, from which, however, it can only be obtained by distillation when they are fresh. The essential oil obtained by distillation in a current of steam is a very mobile liquid, of a light yellow colour; on exposure to the air it volatilizes leaving behind a resinous mass possessing a smell almost identical with that of the essential oil of lemon-grass. Its specific gravity is 0.8872 at 25.5° C; its refractive index is 1.4843 or 40° 12' at 24.5° C.; laevogyre, with specific rotary power $[\alpha]_D = -4^\circ 10' 14''$ at 24.5° C.

Its chemical reactions prove that the essential oil contains aldehydes (75 per cent. by volume, of which 41 per cent. is citral and 34 per cent. citronellal), cineol, limonene, and very small quantities of thymol; it does not contain free acids; on being treated with strong mineral acids it evolves the smell of camphor.

905 - **Medicinal Plants in Tunis.** — CUÉNOD, A., in *Bulletin de la Société d'Horticulture de Tunisie*, Year 13, No. 82, pp. 186-189. Tunis, May 15, 1914.

The natural habitat and uses of the following plants are indicated: *Adonis microcarpa*, *Aloe vera*, *Aceras anthropophora*, *Althaea officinalis*, *Anethum graveolens*, *Apium graveolens*, *Artemisia arborescens*, *Borago offi-*

cinalis, *Callitris quadrivalvis*, *Colchicum autumnale*, *Lavandula multifida*, *Mandragora autumnalis*, *Matricaria aurea*, *Melissa officinalis*, *Mentha viridis*, *Papaver somniferum*, *Pinus halepensis*, *Rosmarinus officinalis*, *Sinapis alba*, *Thapsia garganica*, *Trigonella Foenum-graecum*, *Thymus capitatus*, *Urginea maritima*, *Verbena officinalis*.

9c6 - A New Cover Crop: *Dolichos Hosei*. — CRAIB, W. G., in *Royal Botanic Gardens, Kew, Bulletin of Miscellaneous Information*, No. 2, pp. 76-77. London, 1914.

VARIOUS CROPS

The writer gives a botanical description of a new species, *Dolichos Hosei* Craib, obtained from the Experimental Plantation, Kuala Lumpur, F. M. S. The value of this plant was first noted by Mr. E. Hose, who found it a great success as a cover crop at Sarawak, Borneo.

The plant is indigenous in Borneo. It thrives on all soils but, prefers a sandy loam. It forms a thick dense growth about 6 inches deep and when planted 3 feet apart in six months it prevents the washing of the soil. Seed is difficult to obtain and propagation is readily effected by means of cuttings.

907 - Studies on the Chemical Composition of Mulberry Trees in Japan. — KAWASE, S., and SARTO, R., in *Bulletin de l'Association sericicole du Japon*, Year 1, No. 8, pp. 7-11. Tokio, April 1, 1914.

The writers give the results of their experiments carried out since 1912 at the special School of Sericulture at Ueda.

I. — Chemical changes during the growth of mulberry leaves.

As the result of numerous analyses the following conclusions have been drawn :

- 1). The percentage of water decreases in proportion to the development of the leaves, whilst the percentage of dry matter increases.
- 2). The percentage of protein in the dry matter and the fresh leaves decreases in proportion to the development of the leaves.
- 3). The percentage of crude fibre in the dry matter and fresh leaves increases enormously in proportion as the leaves develop.
- 4). The percentage of nitrogen-free extract increases as the leaves develop.
- 5). The percentage of the various nitrogen compounds, albuminoid, ammoniacal, amino, etc., diminishes as the leaves develop.

II. — Differences in the chemical composition of leaves on standard and dwarf trees. — Experiments were conducted on only one variety, *Komaki*, and show that :

- 1). The percentage of crude fat, protein and lime is higher in leaves of standards than in those of dwarfs. The percentage of nitrogen-free extract is higher in the leaves of standards. The quantity of phosphoric acid and ash is almost constant.
- 2). The composition of the leaves on young branches shows no considerable differences in the two types of trees.
- 3). In the case of old branches, the percentage of crude protein, fat and ash is higher in standards than in dwarfs, but the percentage of nitrogen-free extract and crude fibre is higher in the case of dwarf trees.

III. *Manner of calculating the quantity of manure suitable for the mulberry.* This is based on the results of the preceding analyses and is only strictly applicable to this one variety Komaki. Other investigations with different varieties of mulberries under different conditions are in course of progress in order to determine more general conclusions.

FRUIT
GROWING

908 - *The Cultivation of European Fruit Trees in Upper Tonking.* — CHEVALIER AUGUSTE, in *Bulletin économique de l'Indo-Chine*, Year 17, No. 107, pp. 107-113. Hanoi-Haiphong, March-April 1914.

The region to the north of the delta of the Red river in Tonking has a temperate climate during the greater part of the year, whilst in the uplands it is distinctly cold during the three months November to January. During the months from April to July the temperature rises considerably, especially at altitudes less than 1000 ft. The climate, however, is favourable to the growth of many European plants, including the following fruit trees.

Citrus spp. (oranges, lemons, mandarins, pomeloes). Numerous varieties occur near Tonking. The better varieties are propagated by means of air-layering. Grafting is never practised by the Annamese, but they understand the methods of growing dwarf trees, and sometimes treat citrus trees in this way.

The *persimmon* appears to have been introduced a considerable time, but is not yet very widely distributed. It produces many excellent fruits. The writer observed two varieties: one, small and seedless, the other much larger and containing 5 or 6 seeds.

The *pomegranate* was introduced before the French occupation, but it is chiefly cultivated as an ornamental plant.

Peaches are widely distributed, especially in the north and east, and are often found half wild. It is chiefly cultivated for its flowers rather than its fruits, which are generally of inferior value. A variety of better quality is found the mountainous region inhabited by the Thôis, west of Lao Kay, and in Yunnan on the frontier. The acclimatisation of good European varieties has already been successfully attempted at Cha-Pa at altitudes between 4000 and 5000 ft.

Plums exist in a wild state near the Chinese frontier. There are two varieties in the Langsom district, one resembling the mirabelle and the other the common plum. Another species of wild plum was met with in the Lang Biang mountains.

The *pear* (*Pyrus sinensis*) is commonly cultivated in the South of China in the district of Langsom (Tonking). Its fruits are handsome in appearance, but of poor quality. There is little prospect of improvement by selection, but something might be done by hybridisation and grafting (e. g. on the wild stock of the Langsom district).

Apples are not grown by the natives in Tonking, but Yunnan already sends them to Hanoi. French varieties have been acclimatised at Cha-Pa. A species of wild apple (*Pyrus Doumeri* Bois) has been found in Annam, south of Tonking, on the uplands of Lang-Biang: this should be useful as a stock for grafting European varieties.

The European *vine* was apparently unknown in Tonking before the French occupation. It does not give good results and is often attacked by disease, notably oidium. In the *Flore d'Indo-Chine* (Vol. I, Part 8, 1912) M. GAGNEPAIN records 4 species of *Vitis*, two of which, *V. balanseana* Planch. and *V. pentagona* Diels and Gilg., occur chiefly in Tonking and produce edible grapes.

Figs have been successfully introduced and thrive in Tonking even in the Delta region. They multiply readily and yield an abundance of fruit.

Several species of *blackberry* are found in the wild state in Tonking and in the south of China. The *raspberry* has been successfully introduced and fruits freely.

Red currants and *gooseberries* have also been introduced by M. Miéville at Cha-Pa, and produced fruits during 1913. Other fruits introduced are apricots, quinces, nectarines and walnuts.

The *sweet chestnut* probably exists in certain parts of Yunnan, but it has not been recorded in Tonking. Several wild species of *Castanopsis* occur and one of them is cultivated for its fruits.

Several varieties of *strawberries* are cultivated on a large scale by native market gardeners near Hanoi. The writer found a wild strawberry at Cha-Pa producing fruits without either flavour or smell and another producing fairly tasty white fruits.

It appears that almost all the fruits of the temperate zone can be cultivated in Tonking, but the productive plants are scarcely introduced or are represented by species or varieties different from those cultivated in Europe and generally inferior. The natural advantages of Tonking over those of other neighbouring countries, will enable it to supply European fruits to the markets of the Far East. The imported French varieties do not always maintain their qualities; the flavour is always different, sometimes improved, but generally inferior. The improvements require a long time and are generally the result of new varieties obtained from seed. Researches on the acclimatisation of suitable European fruits can be carried out only by a properly constituted Agricultural Service.

909 - **The Propagation of the Date Palm.** — CORNELL, RALPH, in *Pomona College, Journal of Economic Botany*, Vol. III, No. 1, pp. 418-423 + 3 figs. Claremont, Cal., February 1913.

The first date palms were imported by the United States Department of Agriculture twenty-five years ago, but it is only recently that the propagation of this palm in the arid regions of the south-west has assumed commercial importance. At the present time private enterprise has planted a nursery of 15 000 palms in the Colorado desert. The cultivation of this palm is limited to this region, Chuckarvalla, Mesa de Palo Verde, Imperial Valley, Yuma, Arizona and the region of Phoenix and the Salt River Valley.

The shoots or suckers, which may weigh anything from 10 to 50 lbs., are severed from the parent tree by means of heavy chisels specially made for the purpose. After painting the severed butt ends of the shoots, their tops are trimmed and the whole plant is wrapped and sewed in a covering

of palm fibre preparatory to shipment. They are often packed in boxes to facilitate handling on their long journey, during which they must be kept sufficiently moist to prevent excessive drying, but not so damp as to encourage mould or rot. At the end of their journey the Department of Agriculture requires that they be immersed for two different periods of 15 minutes each in an insecticide of given formula. They must then be planted in nursery form in an isolated place at least 1000 ft. from any other date palms and remain thus quarantined for 12 months. Before the planting takes place they are left exposed to the burning heat of the sun for two days so as to dry them thoroughly and stop any fungous growth that may have started. The young palms are planted so as to lean slightly toward the prevailing wind, in rows 4 feet apart and 3 feet apart in the rows. They must be kept continually moist and are generally watered every other day for the first six weeks. After this time the frequency of the irrigations may be gradually diminished as the young shoots establish themselves in their new home, but the plants should never be allowed to approach a state of dryness. The rooting process is slow and requires 8 or 9 months, sometimes even a year. The percentage of survivals varies considerably, but is generally considered satisfactory.

910 — **Date Palms from Irak.** — POPEUVE, PAUL B., in *Pomona College of Agriculture, Journal of Economic Botany*, Vol. III, No. 2, pp. 459-477. Claremont, Cal., May 1913.

Irak contains the largest area in the world under date cultivation, and its produce, known as Persian Gulf dates, has monopolised the North American markets for a long time. Nevertheless, when date cultivation began to assume economic importance in California, the material for the new plantations was imported from Algeria, as being more easily accessible. Most of the varieties thus obtained ripen late and the harvest in certain districts is often damaged by rain. Further, they reach the markets after they become dominated by the produce from Irak. It is therefore of great importance to obtain early varieties ripening in August and September. The Department of Agriculture obtained several such varieties from Irak in 1913.

In obtaining these varieties the writer visited Oman, Busreh and Bagdad during the winter of 1912-13. He catalogued and described 112 varieties previously unknown, and about 9000 suckers were shipped for propagation.

A description of the above varieties is given in this article.

911 — **New Fruits on North American Markets.** — *The Journal of Heredity*, Vol. IV, No. 4, pp. 179-184 + 3 figs. Washington, April 1914.

The so-called "Pili nuts" which have been sold on American markets for many years at about 28 cents per lb. are the fruits of *Canarium ovatum* and *C. luzonicum* from the Philippines, and to a less extent of *C. commune* from the Dutch East Indies. The first two species exist in a wild state, whilst the third is cultivated. These trees (which also yield an oleo-resin) would be difficult to acclimatise in the United States but would be more suitable to Central and South America.

The Paradise nut is the fruit of various species of *Lecythis*, chiefly

L. Zabucajo, cultivated in Brazil, Venezuela, and Guiana. It is sold in the United States at about 80 cents per lb.

The Queensland nut is the fruit of *Macadamia ternifolia* and is already being experimented with in the south of California and other warmer regions of the United States, where it promises to become of considerable industrial importance.

912 - **The Influence of Chemical Manures on the Keeping Qualities of Pears.** — RIVIÈRE, GUSTAVE, and BAILHACHE, GABRIEL, in *Journal de la Société Nationale d'Horticulture de France*, 4th Series, Vol. XV, pp. 435-438. Paris, June 1914.

These experiments were conducted with pears of the variety Passe-Crassane, from July 5 to August 30, 1913. A row of 12 trees was chosen, four of which were used as a control and received no application; the next four trees received 10 litres of water each week and the remaining four received 10 litres of a solution containing 1 gm. of the double phosphate of potash and ammonia per litre. The fruit was harvested on October 18 and stored until fully matured, when it was analysed. The results were as follows.

1) In each group the number of fruits per tree was approximately the same (22 to 25); the volumes and weights varied slightly (383, 333 and 366 gms.).

2) The application of manures does not injure the keeping qualities of this variety (Passe-Crassane), since the fruit of the manured trees remained good longer than that of the others.

3) Manuring did not affect the chemical composition of the fruits to any considerable extent.

913 - ***Eremocitrus*, New Genus of Citrus Trees from Australia.** — SWINGLE, WALTER E., in *Journal of Agricultural Research*, Vol. II, No. 2, pp. 85-100 + 7 figs. + 1 table. Washington, May 1914.

The writer gives the botanical description, distribution, morphology phylogeny and mode of culture (grafting, hybridising and selection), of *Eremocitrus glauca* Swingle (syn: *Triphasia glauca* Lindl.; *Atalantia glauca* Benth.) indigenous in the north-east of Australia. It is a spiny shrub, showing a marked morphological adaptation to desert conditions and characterised by a winter resting-stage and absolute resistance to cold. Its fruits are small, pyriform or roundish, and edible. It grafts easily with all common cultivated citrus trees.

914 - **Hybrid Direct-Bearers in the Côtes-du-Rhône District (France) in 1913.** — DESMOULINS, AMÉDÉE, and VILLARD, VICTOR, in *Le Progrès Agricole et Viticole*, Year 35, Nos. 29 and 30, pp. 81-89 and 108-111. Paris, July 19 and 26, 1914.

After a series of observations made in 1913 on Couderc, Seibel and other hybrids, the writers conclude that among the many varieties obtained by hybridizing there are a certain number which are decidedly valuable. The recent hybrids obtained are much superior to the earlier ones, as the writers have seen in studying the question during the last fifteen years. Nevertheless the writers do not think it possible at present to utilize hybrid direct-bearers for the great wines, which for the moment

must limit themselves to fine local grafted stocks. On the other hand these hybrids may be advantageously employed in districts which produce only common wines; thanks to them the production of fairly good wines of current consumption becomes steadily more reliable and its cost price cheaper.

Their functions, according to M. Couderc, are: 1) to allow the vine to be grown in localities in which it is not the principal crop; 2) to get a crop in years in which there is much mildew and wine is dear (a kind of insurance); 3) diminish expenses when wines are cheap.

As for the question whether these hybrid direct-bearers are to be grown on their own roots or grafted, the writers believe that there is evidently more safety in grafting them, but that the following direct-bearers may be grown on their own roots on the soils mentioned below:

1. *On very dry soils*: Couderc 123-II, C. 7120, C. 202-75, C. 106-46, C. 272-60, Seibel 1000, Berthille-Seyve 450.

2. *In medium soils*: Seibel 2007, Castel 1028, Castel 13-706, Gailard 157, Berthille-Seyve 618.

3. *In good soils* (wheat soils): first the varieties mentioned above as suitable for medium soils, and then Seibel 1, S. 128, S. 880, S. 2660, S. 2653, S. 4111, Malègue 474-5.

The writers have also studied the dates of shooting of direct-bearers, which it is important to know, since spring frosts may injure vines which open early. It is evident that in districts liable to late frosts, other conditions being equal, late varieties are to be preferred. The susceptibility of a variety to spring frosts is not necessarily due to early shooting, as other factors may modify this sensibility. The time at which the buds open is also affected by various factors, but at the same time should be considered in the choice of a hybrid.

By measuring for each variety at the same period (15th to 22nd of April) the same number of shoots and taking the average of such measurements, the writers have established for each hybrid the average length of the shoots, by means of which they could measure the difference in shooting of the varieties under comparison. The results of these measurements are here given:

Length of shoots between 15th and 22nd of April	Group
1 or 2 cm.	late
3 or 4 cm.	medium
5 or 6 cm.	early
7 cm. or more	very early

The question as to why the upper limits of forest growth are higher in the centre of mountain groups than on the outside has still received no satisfactory answer.

The two principal explanations attempted are based on temperature and atmospheric precipitations respectively. FLAHAULT inclines to the latter

factor and in order to explain the phenomenon, distinguishes between the subalpine belt with maximum precipitation, and the alpine region proper. The great moisture-laden currents of air which strike the mountain ranges follow the average slope of the continent inland; the parallel layers, laden with varying amounts of moisture, rise gradually as they approach the high mountain masses. But the maximum of precipitation supposed by this theory is not at all demonstrated; all that the records show is that the first chains of mountains act as a screen to the inner masses and prevent a greater rainfall there. It is further to be noted that Flahault's botanical characterization of the subalpine zone (presence of *Pinus Cembra*, *P. uncinata*, *Larix europea* and *Picea excelsa*) is somewhat artificial; in particular, spruce agrees more nearly with silver fir in not reaching the tree-limit where this is highest.

According to Dr. MAREK the alpine limits of forest growth are lower where the annual sum of precipitations is highest. This conclusion, which seems paradoxical and in contradiction with the laws of plant biology and with current observation, is nevertheless justified if instead of considering only moisture it be admitted that other factors contribute to this result. Since all the study which has been based on the influence of temperature has yielded insufficient results not agreeing with each other, Dr. Marek sees in the factor light the one which more especially justifies the paradoxical aspect of his law. The factor light must therefore be studied with attention in its effects and must be subjected to accurate measurements (1).

The study of alpine limits would be more complete if the three essential factors of plant life—light, moisture and heat—were all considered together. It would then be seen that trees begin to fail, where, owing to the want of heat, and notwithstanding the light, growth becomes so slow that it does not counteract the effect of drought. They disappear when the time is too short for the seedlings to produce during the growing season a sufficient formation of wood to afford protection against the injury caused by cold.

The fruiting of trees diminishes as their situation becomes colder, and this decrease is more marked in clouded and moist positions. It is thus evident that the warm and sunny localities of the central ranges are more advantageous than the spurs or outer chains; this is one of the most important reasons of the difference of level of the alpine limits of forest vegetation.

LIVE STOCK AND BREEDING.

- 916 — **Studies on the Toxicity of Cicuta or Water Hemlock.** — MARSH, C. DWIGHT, and CLAWSON, A. B. (Bureau of Plant Industry); and MARSH, HADLEIGH (Bureau of Animal Industry); in *Bulletin of the U. S. Department of Agriculture*, No. 69, 27 pp. + 4 plates. Washington, March 1914.

The writers give an introductory account of the historical works dealing with *Cicuta*, a list of its poisonous species, its resemblance to *Conium*, and its pathological effects.

(1) See also No. 893, above.

Experiments were conducted in 1910 and 1911 with specimens of *Cicuta occidentalis* occurring in irrigated land in the Ohio Creek Valley, Colorado. Sheep and young cattle were used to determine: 1) whether the plant is poisonous in summer and early autumn; 2) the danger to live stock from eating hay containing *Cicuta*; 3) the symptoms and effects of *Cicuta* poisoning.

The conclusions of the writers are as follows:

1. The symptoms of *Cicuta* poisoning are characterized by nausea, pain and violent convulsions. The prominent lesions, as found in autopsies, are congestion of the lungs, kidneys, and central nervous system, with inflammation of the alimentary canal.

2. So far as is known all the higher animals are susceptible to *Cicuta* poisoning.

3. A very small quantity of the root may be fatal, but the amount varies with the season and the period of time during which it is eaten. The plant is very poisonous at all stages of its growth.

4. The toxic principle is largely confined to the rootstock; the tops under ordinary circumstances are not poisonous and neither the tops nor the seeds are dangerous when present in hay.

5. The best remedy is an emetic; hypodermic injections of morphin (from 1 ½ to 3 or even 10 grains in the case of larger animals) are recommended to control the convulsions.

The following species of *Cicuta* are reported as poisonous: *C. maculata*, *C. bulbifera*, *C. vagans*, *C. Bolanderi*, *C. occidentalis*, *C. californica*, *C. Curtisii*, *C. Douglasii*, *C. purpurca*, *C. tenuifolia* and *C. virosa*. There is every reason to believe that all species of *Cicuta* are poisonous, and possibly all equally so.

A full bibliography of *Cicuta*, comprising 49 works, is appended.

917 - **Experimental Investigations into the Cause of Pernicious Anaemia or Typhoid Anaemia in Horses.** — SEYDERHELM, K. R. (Director of the Municipal Slaughterhouse, Strassburg) and SEYDERHELM, R., in *Berliner Tierärztliche Wochenschrift*, Year XXX, No. 34, pp. 609-612. Berlin, August 20, 1914.

CARRÉ and VALLÉE demonstrated and VON OSTERLAG and MAREK confirmed that infective pernicious anaemia in the horse is caused by an ultra-visible virus present in the blood, faeces and urine. There remained, however, some doubts as to the manner in which infection took place, as it was observed that in order to procure infection by food soiled with excrements such quantities of these were necessary as to preclude its happening in practice. It was further observed [that only in very rare instances did healthy horses contract the disease through living alongside of sick ones. On the other hand it has been observed that very often the appearance of the disease followed on the horses being put out to graze. Consequently the hypothesis has been advanced of the existence of an intermediate host of the pathogenic agent. Various writers have suspected intestinal parasites, flies, and ticks of playing the part of intermediate hosts, but none were able to demonstrate the fact.

The writers of this paper proposed to demonstrate experimentally the existence of such an intermediate host. In the autopsies of 85 horses affected by pernicious anaemia they *always* found larvae of *Gastrophilus* on the mucous membrane of the stomach. An intravenous injection of an extract of *Gastrophilus* collected from a horse affected by pernicious anaemia caused a very rapid poisoning—followed by death in 12 minutes—of a horse; post-mortem examination showed violent haemorrhagic inflammation. The extract was perfectly harmless for other domestic animals, such as cattle, sheep, rabbits, fowls, guinea-pigs, etc., but not for the ass.

The writers showed that the larvae of *Gastrophilus* contain a hitherto unknown animal poison that they call oestrin (östrin), which is characterized by its being poisonous only for horses and asses. Injections in doses inferior to the mortal dose cause intense motor excitement of all the muscles and fever; the next day a considerable decrease of haemoglobin and of erythrocytes is observed. The activity of the extract is not diminished by high temperatures or by the presence of various chemical conditions, whence the conclusion is drawn that the hypothesis of its containing micro-organisms is to be set aside. Another fact points to this view, namely that the disease appears without a preceding period of incubation. Repeated injections of weak doses cause the animal at last to suffer persistently from pernicious anaemia, with all its characters, and then to die. The serum of the blood of horses affected by pernicious anaemia following upon injections of extract of *Gastrophilus* larvae, when injected into healthy horses, causes pernicious anaemia, which in its turn can be transmitted to other healthy horses by injection. The writers conclude that the cause of the disease is oestrin secreted by *Gastrophilus* larvae.

Not all horses which are hosts of *Gastrophilus* are affected by pernicious anaemia; but all the extracts of larvae are poisonous, even those taken from healthy animals. While the extracts of larvae of *Gastrophilus equi* are relatively of low toxicity, those of *G. haemorrhoidalis* are much more so. In horses affected by pernicious anaemia the writers almost always found *G. haemorrhoidalis*, besides *G. equi* and *G. nasalis*; while in healthy horses the former is usually absent.

The discovery of the writers affords an explanation of the following clinical observations on the natural infection:

1. The disease appears in its acute form mostly from May to October, that is during the period in which Oestrids fly about and deposit their eggs on horses.

2. The intensity of the disease varies from one year to another; the number of Oestrids also varies from year to year, probably according to the season.

3. The appearance of the disease is almost always connected with the animals being turned out to graze.

4. The disease is hardly ever propagated from diseased horses to healthy horses near them.

5. The disease never appears in horses that are regularly groomed, for instance military horses.

The disease may be treated by the expulsion of the *Gastrophilus* larvae only when it is incipient. The writers investigated whether antibodies were formed against oestrin and succeeded in obtaining a highly efficient curative and preventive serum.

Pernicious anaemia of horses may thus be controlled prophylactically by the destruction of Oestrids.

After prolonged dosing with the extract containing oestrin at first only transitory symptoms appear ; then the horses begin to be sickly and at a certain stage the disease becomes more serious, even without further injections, and leads inevitably to increasing anaemia, to high fever and then death. In this latter period the blood contains an agent that transmits the disease to healthy horses. The nature of this body cannot be determined with certainty, but judging from its behaviour to physical and chemical agents it possesses properties which differ from those of oestrin. In the first place it is unstable under the action of heat. It might be a substance that could be represented by a chemical formula and that is liberated by oestrin from certain parts of the horse's tissue and has the property of acting on the healthy tissues in the same way as oestrin itself, namely of liberating from the tissues a compound similar to itself. Thus the "ultra-visible virus" of the pernicious anaemia of the horse would be a product of anomalous metabolism formed during the course of the disease and which, transmitted to a healthy horse, sets up the pathogenic conditions which cause the same metabolic product to be formed. The process may thus be repeated indefinitely. The research work carried on at the Breslau Chemical and Physiological Institute confirms this hypothesis.

In Japan also investigations have been carried out (by SHIGA and others) into the pernicious anaemia of horses during the last five years on 980 horses and other domestic animals. They have proved that the disease is transmissible to pigs, that infection by means of faeces and urine has no practical importance, and that the appearance of the disease is connected with the presence of winged insects. By means of only one inoculation of *Gastrophilus* larvae it was not found possible to cause the disease. The results obtained by the Japanese commission thus agree with those of the writers.

918 - *Microphylaria* in Horses affected by Haemorrhagical Boils. — ROMANOVITCH (Veterinary Laboratory, Petrograd) in *Comptes Rendus hebdomadaires des séances de la Société de Biologie*, Vol. LXXVII, No. 26, pp. 390-391. Paris, July 24, 1914.

Horses in Southern Russia are often infested by *Filaria haemorrhagica*. This parasite lives in the subcutaneous connective tissue and causes the formation of haemorrhagic boils on the surface of the skin ; when these break a certain amount of bleeding takes place.

On examining drops of the blood the presence of a non-sheathed microphylaria was observed ; when fixed on the object glass by the alcohol and ether mixture this measured 150 to 224 μ in length. It tapers towards its posterior extremity which ends in a longish tail.

The blood from the haemorrhagical boils contains also eggs, which enclose completely developed embryos. The shells of the eggs are very thin, and easily coloured.

In the blood taken from the jugular vein of horses affected by these boils the same microphylaria was always found.

The writer examined five horses suffering from these boils and three healthy ones from the same district. In the former he always found microphylariae, while the latter were free from them; from this he concludes that the microphylaria in question is the embryo of *Filaria haemorrhagica*.

919 - Effect of Low Temperatures on the Bacilli of Anthrax. — Contribution to the Study of the Treatment of Meat Superficially Infected by Anthrax Bacilli. POPPE, KURT (Veterinärabteilung des Kaiserlichen Gesundheitsamts) in *Zeitschrift für Fleisch- und Milchhygiene*, Year XXIV, Part 21, pp. 485-489 + 1 fig. Berlin, August 1, 1914.

The frequent appearance of localized anthrax in pigs has given a special importance to the question of judging the fitness as food of pigs thus affected, as well as of the flesh of animals that have been slaughtered together with such pigs, and which has come into contact with them.

According to the legislation at present in force in Germany pigs affected by localized anthrax are seized and declared unfit for human food, and the meat and offal that comes into direct or indirect contact with animals affected, or suspected of being affected, by localized anthrax or with their flesh, is for the most part likewise seized and declared unfit for human food or only fit under certain conditions.

In Prussia a Ministerial Order of April 12, 1913, provides that the last-mentioned meat may be exempted from seizure when upon examination it appears that no germs of anthrax have been conveyed to it. Similar legislative provisions have been adopted in most of the other German States.

The fact that the flesh of healthy pigs which becomes infected superficially at the slaughter-house is mostly treated with the same severity as diseased meats, led to investigating whether, besides the treatment with steam, low temperatures would render it harmless.

After referring to the purely scientific researches of Pictet and Young, Allan Mac Fayden and Belli (who experimented at the temperature of liquefied air) and to the more practical ones of Klepsoff, who concluded that *Bac. anthracis* may be rapidly killed by very low temperatures and in some days at higher temperatures (in 12 days at -24°C , -11.2°F .), the writer describes his own experiments, which consisted in keeping cultures of *Bac. anthracis* in pieces of superficially infected meat, blood and organs of infected animals in ventilated cold storage at the average temperature of -15°C . ($+5^{\circ}\text{F}$.) with average moisture of 75 to 80 per cent. The details of the experimental results are collected into tables from which the writer concludes that anthrax bacilli on meat and in cultures do not lose any of their vitality or virulence even after two weeks' storage at -15°C . Consequently, even prolonged refrigeration does not render meat superficially infected with anthrax bacilli harmless.

920 - **Vaccination against Hog Cholera** (1). — CRAIG, R. A., and WHITING, R. A., in *Purdue University Agricultural Experiment Station, Bulletin* No. 173, Vol. XVII, pp. 441-474. Lafayette, Indiana, March 1914.

The purpose of this bulletin is to inform farmers as to the nature of hog cholera and the methods of controlling this disease. The disease exists in all sections of the United States, but is especially prevalent in the corn-raising States, where it is considered to be the disease of greatest economic importance. In Indiana alone the annual loss from this cause amounts to about \$3 000 000, excluding the loss resulting from the marketing of young hogs in neighbourhoods where the disease is prevalent. In 19 years (1894 to 1912) 58 800 409 pigs were raised in Indiana, and of these 6 754 771 died of cholera.

In 1908 Drs. Dorset and Niles, of the Bureau of Animal Industry, demonstrated the method of producing an anticholera serum and its application. A number of State laboratories for the production of anti-sera were then established. For the production of a laboratory virus it is best to use young thrifty hogs weighing from 80 to 100 lbs. They should be inoculated with 2 or 3 cc. of hog-cholera blood of sufficient virulence to kill a susceptible hog in from 8 to 14 days, but preferably in 8 to 10 days. When the hog has developed fatal symptoms of disease, it is killed by cutting the carotid artery near the base of the neck. In order to increase the quantity of virus that may be secured from a hog showing fatal symptoms of hog-cholera, from 10 to 15 cc. per lb. of body-weight of a sterile physiological salt solution are injected into the peritoneal cavity of the hog two to three hours before it is bled. After the hog has bled, the solution is removed by tapping the peritoneal cavity with a side-neck cattle trocar. The lesions of hog cholera should be marked and acute in character; blood from virus hogs showing fatal symptoms of disease within 6 days following exposure and those showing lesions of septicæmia in the liver, spleen and skin, should be rejected.

The immune hogs used for the production of serum should weigh from 150 to 175 lbs., since after several re-hyperimmunizations covering a period of from 4 to 6 months the animal may double in weight and become difficult to handle. The injections should be intra-muscular or subcutaneous in the region of the thighs or shoulders. From 10 to 12 cc. of blood per lb. of body-weight are injected on two occasions with an interval of one week between them.

In the intra-peritoneal method, 10 cc. of cholera blood per lb. of body-weight are injected into the peritoneal cavity. This method is not recommended owing to the inferior serum produced.

In the intravenous method, 5 or 6 cc. of virus per lb. of body-weight are injected into the vein of the ear. The injection may be made once, or twice with an interval of one week.

The virulent salt solution recovered from the abdominal cavity of the cholera hog is about one half as virulent as the cholera blood and should

(1) See also original article by Dr. F. Huttyra: « Protective Inoculation against Swine Fever in Hungary ». — *B. June 1914*, pp. 707-712. (Ed.).

be used in double the quantity. It is advisable to inject the virus intramuscularly in the proportion of 20 cc. per lb. of body-weight.

The hyperimmunised animals are ready for bleeding in from 10 to 14 days after injection of the virus. At each bleeding, which is effected on the tail, 6 cc. of blood per lb. of body-weight may be removed, but the animals should not be bled more than three times at weekly intervals before re-hyperimmunising. This process requires only one half the quantity of cholera blood used for the first injection, and the animal should not be re-hyperimmunised the same day it is bled. It is ready for bleeding in a week or ten days after re-injection with the virus. The bleedings and injections can be practised until the tail becomes so short that it cannot be handled. The hyperimmune animal is then bled to death by cutting the blood vessels near the base of the neck, but it is advisable to re-immunise before making this final bleeding.

The hyperimmune blood is defibrinated and preserved by adding one-tenth of its volume of 5 per cent. solution of phenol. Before being used for vaccination purposes it should be carefully tested for potency and the presence of septic organisms.

The vaccination of a hog by the single method consists in giving it anti-hog-cholera serum, which confers immunity not longer than four weeks. Vaccination by the double method consists in giving an injection of anti-hog-cholera serum and one of cholera blood. The writers recommend the following doses of anti-serum: for pigs weighing from 50 to 100 lbs., one half cc. per lb. of body-weight: for pigs weighing from 100 to 300 lbs., from 50 to 90 cc. In using cholera blood: pigs weighing less than 100 lbs. receive 1 cc. and pigs weighing more than 100 lbs. 1 $\frac{1}{2}$ to 2 cc.

During the period July 1908 to March 1914 the State of Indiana produced 9 881 998 cc. of serum; this was used for the vaccination of 247 049 hogs; the percentage loss in the healthy herds was 2.39, whilst that of the infected herds was 9.02.

An extract of the law relating to the prevention, spread and control of swine disease in Indiana is appended.

921 - The Influence of Food Poor in Lime on the Composition of Growing Bones. — WEISER, STEPHAN, in *Biochemische Zeitschrift*, Vol. 66, Part 1-2-3, pp. 95-114. Berlin, July 29, 1914.

The writer kept a group of three young pigs, from the 15th of January to the 1st of October, on food rich in lime and another perfectly similar group on rations poor in this substance. After the animals were slaughtered, the bones were analysed; it was found that a food poor in lime diminished the development of the animals to such an extent that from the beginning their increase in weight was about 20 per cent. less than that of the pigs fed on food rich in lime. The prolonged want of lime always caused the appetite to diminish and consequently the live-weight also.

The pigs that had not been fed enough lime had in general deformed pliable bones, thinner and easier to cut than those of the other lot. The differences in growth and weight of the skeletons, however, could not be determined. Out of the total weight of the body of the pigs poor in lime,

the weight of the fresh bones and of the dry matter represented a greater percentage (14.29 and 5.05 per cent.) than in the other lot (8.74 and 3.91 per cent. respectively).

The bones of the lot lacking lime contained considerably more water and much less ash than those of the others, but their fat content was nearly the same.

The differences in the ash content were least in the bones of the skull and greatest in the ribs. In the pigs deficient in lime, out of the total ash content of the skeleton a greater proportion was found in the skull than was the case with the other lot.

The bone-ash of the former is considerably poorer in CaO than that of the latter; a difference in the same direction, though smaller, was observed also in the P₂ O₅ content.

The essential difference between the composition of the bone-ash of animals deficient in lime and that of animals rich in lime is that the former includes considerable quantities of alkalis (Na₂ O, K₂ O).

FEEDS
AND FEEDING

922 - Investigations into Factors affecting the Handling of Wheat Hay, including a Study of its Digestibility. — PERKINS, A. J.; PHILLIPS, J. H.; SPAFFORD, W. J., and MAY, N. S., in *The Journal of the Department of Agriculture of South Australia*, Vol. XVII, No. 7, pp. 720-755. Adelaide, 1914.

The experiments of 1912 and 1913 confirm the conclusions of 1911 (1) and include feeding trials.

King's White wheat was grown on half-acre plots which were cut at intervals of one week from the 10th of October to the 20th of November. The results are given in Tables I-V.

TABLE I.

Details of seven cuts of hay taken between full bloom and ripeness.

Date of Cutting	Yield per acre		Moisture per cent.	Loss of weight on drying per cent.	Percentage of ears by wt. in hay with 10 % moisture
	tons.	cwt. lbs.			
1. — Oct. 10	1	17 86	11.31	71.33	12.26
2. — " 16	2	2 20	10.27	61.32	15.17
3. — " 23	2	9 77	10.71	53.11	19.08
4. — " 30	2	13 55	9.95	47.37	24.68
5. — Nov. 6	2	9 7	8.27	49.15	34.56
6. — " 13	2	10 93	7.53	33.63	37.09
7. — " 20	2	8 67	7.20	24.00	39.41

TABLE II. -- *Composition of hay cut in various stages of maturity, in terms of oven-dried material.*

	1st Cut (Oct. 20)		4th Cut (Oct. 30)		7th Cut (Nov. 20)	
	Ears.	Culms and Hay.	Ears.	Culms and Hay.	Ears.	Culms and Hay.
Mineral matter.	7.25	7.88	6.07	7.08	4.83	6.43
Organic matter	92.75	92.12	93.93	92.92	95.17	93.57
Proteins	11.86	4.56	11.16	4.38	9.71	2.28
Fat	1.16	0.64	1.10	0.94	1.10	1.10
Carbohydrates	49.66	54.38	63.06	53.90	71.34	48.12
Fibre	30.07	32.54	18.71	33.70	13.02	42.07

TABLE III. -- *Distribution of constituent parts of wheat hay cut in various stages of maturity (lbs. per acre).*

No. of Cut.	Mineral Matter	Organic Matter	Proteins	Fat	Carbohydrates	Fibre
1.	292.7	3 458.7	204.6	26.4	1 209.3	2 018.2
4.	368.5	5 026.1	326.5	51.5	1 618.4	3 029.6
7.	292.9	4 757.8	263.0	55.5	1 546.6	2 892.6

TABLE IV. -- *Chemical composition of wheat hay oven dried immediately after cutting and of wheat hay analysed after ordinary field drying process.*

	Oven-dried per cent.	Field-dried per cent.
Mineral matter	6.63	6.91
Organic matter.	93.37	93.03
Proteins.	6.13	6.13
Fat.	0.80	0.76
Fibre	28.02	28.36
Carbohydrates	58.42	57.84
Moisture.	58.94	11.99

TABLE V. -- *Mean coefficients of digestibility of the constituents of wheat hay cut in various stages of maturity.*

Constituents	Cut Oct. 10	Cut Oct. 30	Cut Nov. 20
Dry matter	54.32	51.82	48.83
Mineral substances.	24.22	29.38	12.72
Organic matter	56.64	53.48	51.15
Proteins	60.10	53.87	60.62
Fibre	46.99	32.42	30.12
Carbohydrates and fat	61.56	62.91	59.94
Albuminoid ratio	1 : 19	1 : 15.25	1 : 12.24

Conclusions.

1. The yield of dry fodder from wheat varies according to the period of cutting; the average relative yield per cutting during the flowering period is as follows :

Days after flowering	Percentage dry fodder
6	20.31
13	24.02
21	36.04
28	32.62
35	21.90
42 (grain ripe)	14.24

The maximum yield is obtained by cutting 3 weeks after the period of full flower, when the grains leave the milky stage. This is the case with early wheat grown in a climate requiring six weeks between flowering and maturity.

2. There is a greater increase in weight in the ears than in the stem and leaves during the three weeks following the flowering period. At the end of three weeks the weight of the ear continues to increase, whilst that of the stem and leaves begins to decrease, and two weeks before maturity actually weighs less than at the flowering period. The following figures show the average (1911 and 1912) percentage increase in weight after the flowering period.

Days after flowering	Ear	Stem and leaves
0	100.00	100.00
6	137.77	118.28
13	153.10	119.98
21	246.75	120.48
28	321.05	106.70
35	337.00	92.54
42 (grain ripe)	340.40	83.33

Cutting the crop after the grains have passed the milky stage results in a loss of nutritive substances and a badly balanced hay, and unless harvested at least two weeks before maturation the hay deteriorates considerably.

3. The relative differences in chemical composition of the crop cut at different stages are as follows : *a*) a progressive diminution in the percentage of ash and a corresponding increase in organic matter during maturation ; *b*) the percentages of albuminoid substances tend to increase during the first three weeks, then diminish until complete maturation of the grains ; *c*) the percentage of fatty matter appears to remain constant during the whole period ; *d*) the percentage of carbohydrate in the ear increases regularly during the six weeks (being 50 per cent. of the dry matter at flowering and 72 per cent. on maturation), and it is balanced by a corresponding decrease in the stems and leaves ; *e*) conversely, while the percentage of cellulose gradually increases in the stems and leaves (from 32 per cent. at flower-

ing to 42 per cent. on maturation), it decreases in the ear (from 30 per cent. at flowering to 13 per cent. on maturation).

4. There is a considerable loss of dry matter in the grains during the two or three last weeks, reaching 22.9 per cent. of the highest yield in 1911 and 6.41 per cent. in 1912. This loss is undoubtedly due chiefly to the breaking of the leaves and partly to the separation of grains or other accidents, such as a lowering or suspension of the assimilatory function, or washing out of the porous tissues by rain. The annual loss of mineral matter (20.51 per cent. in 1912-13) was considerably greater than that of the organic matter (5.34 per cent.); from this it is concluded that a migration of mineral substance towards the root takes place as maturation proceeds.

5. The loss of weight on drying decreases as the time of cutting approaches the ripening stage. In the case of the 1st, 4th, and 7th cuts it was respectively 71.45, 47.44 and 24.04 per cent. of the green weight during the flowering period, and less than $\frac{1}{4}$ of the green weight after maturity.

6. The percentage moisture in the hay varies slightly according to the conditions of drying. Generally hay cut early retains more moisture than hay cut late. South Australian wheat hay has an average of 10 per cent. of moisture.

7. The loss of weight of hay allowed to dry naturally in the fields is not exclusively due to the evaporation of moisture. The writers consider that at least 1.5 per cent. of this loss is due to the decomposition of organic matter, such as carbohydrates. Comparing the composition of the plant with that of the hay dried *in situ*, and assuming both to have contained the same proportions of water, the writers found a loss of 4.05 per cent. of dry weight, or 1.66 per cent. of the green weight, which they distribute as follows: protein matter 0.10, fatty matter 0.03, cellulose 0.33, carbohydrates 1.20.

Digestibility experiments on horses showed that wheat hay cut at the flowering period is more digestible than hay cut later and that the digestibility diminishes in proportion to the lateness of the cutting. There is a difference of 12 per cent. in the digestibility of hay cut at the flowering period and that cut when the grain is ripe. The decrease in digestibility is more noticeable in the case of the albuminoid and cellulose constituents and less so for the mineral matter and carbohydrates. The ratio of the digestible nitrogenous matter to the digestible non-nitrogenous matter is higher in the case of hay cut early, owing to the greater digestibility of the albuminoids in early hay and the predominance of carbohydrates in hay cut late.

Thus, there is everything to lose and nothing to gain in postponing the cutting of the crop until the grain begins to harden. The practice of judging the value of hay from its colour is fully justified, a distinct green being the best colour.

- 923 - **Bacteriological Research on Ensilaged Forage.** — GORINI, COSTANTINO, in *Bollettino dell'Associazione Italiana dell'industria dello zucchero e dell'alcool*, Year, VII, No. 4, pp. 83-90. Bologna, July 1914.

The bacteriological researches carried out by the writer (1) justify the suggestion, which he made in 1907, that selected lactic ferments should be added to ensilaged forage. This is all the more so as the forage from butyric silos, though it may be considered as successful, presents some disadvantages. It must especially be noted that intestinal troubles are observed in the cattle fed on such ensilage, and that this forage is to be avoided in dairies, not only for the odours and flavours which it may impart to milk and butter, and especially to the bacterial flora, of a gas-forming nature, which may cause cheese made with such milk to swell.

- 924 - **Live Stock Feeding Experiments in Ireland, 1912-13.** — *Department of Agriculture and Technical Instruction for Ireland, Journal*, Vol. XIV, No. 3, pp. 456-470. Dublin, April 1914.

These experiments are in continuation of those begun in 1912. (*Journal*, Vol. XIII, No. 3).

1. — Pig Feeding Experiments.

Series I. *Comparison of potatoes and meal.*

The object of these experiments was to determine if pigs can be fattened successfully without potatoes. During the past two seasons the experiment was conducted with 148 pigs at 20 centres distributed throughout 13 counties. The average age of the pigs was 13 $\frac{1}{2}$ weeks and the duration of the experiment 108 days. At each centre the pigs were divided into two lots. Lot 1 received a certain quantity of potatoes in addition to other foods (maize, pollard and separated milk), whilst lot 2 was given an extra pound of the meal mixture in place of every 4 lbs. of potatoes fed to lot 1.

The results obtained are set forth in Table I.

Whilst these figures show that the average daily gain in live-weight was practically the same for each lot of pigs, nevertheless, in respect to rate of increase in live-weight, cost of producing a given increase in live-weight and quality of pork, the pigs fed on meal alone were slightly, but fairly uniformly, superior to the pigs which received potatoes. The question as to whether potatoes should be sold or fed to pigs depends largely upon the current prices of potatoes and meal respectively. It is very doubtful whether it is economical to feed pigs on saleable potatoes if they can be sold for one-fourth the value of meal, in addition to the cost of marketing.

Series II. *Barley meal compared with maize meal.*

This experiment was conducted with 106 pigs at 15 centres. The average age of the pigs at the commencement was 13 weeks and the duration of the experiment 100 days.

The results obtained are set forth in Table II.

(1) See No. 541, B. June 1914.

TABLE I.

Food.	Price per cwt.	Quantities.			
		Lot 1.		Lot 2.	
		cwt.	lbs.	cwt.	lbs.
Maize meal	7 6	141	21	220	92
Pollard	7 0	89	101	146	26
Oat meal	12 0	0	84	0	84
Potatoes	2 0	524	28	—	—
Separated milk	1d. per gallon.	3247	gallons	3247	gallons
Linseed cake	10 6	2	28	2	28
Table refuse.	— —	—	—	—	—
Total cost of food	— —	£155 10 s.		£149 13s.	
Average increase in live-weight	— —	1 cwt. 50 lbs		1 cwt 54 lbs	
Cost of producing 1 cwt. live-weight increase	— —	£1 9s 1d.		£1 7 3d.	

TABLE II.

Food.	Price per cwt.	Quantities.			
		Lot 1.		Lot 2.	
		cwt.	lbs.	cwt.	lbs.
Barley meal	7 0	134	99	—	—
Maize meal	7 6	—	—	135	23
Potatoes	2 0	339	9	335	65
Swedes	8s per ton	35	0	35	0
Separated milk	1d per gallon	1062	gallons	1051	gallons
Linseed cake	10 6	2	0	2	0
Table refuse	— —	—	—	—	—
Cost of food	— —	£87 15s 10d		£90 17s 8d	
Average live-weight increase	— —	1 cwt. 34 lbs.		1 cwt. 37 lbs.	
Cost of producing 1 cwt. live-weight increase	— —	£1 5s 6d		£1 5s 10d	

In two experiments where swedes were fed instead of potatoes, the pigs made very slow progress, the average daily increase scarcely exceeding one pound per head. The results of these experiments appear to indicate that maize is worth approximately 10s per ton more than barley meal for pig feeding. As regards quality of pork, barley meal seems to be slightly superior to maize meal. It should be noted that the estimated

cost of production is based on the cost of the food only. In practice, many other items, such as attendance, fuel, risk and interest on capital have to be considered.

2. — Calf Feeding Experiment.

This experiment was designed to compare the value of oat meal and wheat meal respectively, when used in conjunction with maize meal and ground linseed for calf feeding. It has been carried out during the past two seasons at 31 centres. 244 calves were selected and divided into two lots; their average age at the commencement was seven weeks and the experiment lasted 117 days.

The results are given in Table III.

TABLE III.

Food.	Price per cwt.	Quantities.			
		Lot 1.		Lot 2.	
		cwt.	lbs.	cwt.	lbs.
Oat meal mixture	14 0	105	92	—	—
Wheat meal mixture	13 0	—	—	105	83
Linseed cake	10 6	31	72	31	72
Whole milk	5 d. per gallon	91	gallons	91	gallons.
Separated milk	1 d. per gallon	18 765	gallons	18 765	gallons
Total cost of food	—	£170 15s 5d		£16 5s 8d	
Live-weight increase (mean)	—	1 cwt. 78 lbs.		1 cwt. 77 lbs.	
Cost of production of 1 cwt. of increase . .	—	16s 6d		16s 1d	

In the above estimates no account is taken of the value of the hay consumed or the grazing, but these items are the same for both lots. On the whole, there was no appreciable difference in the health or appearance of the two lots of calves. The difference in the cost of production is so small that it would appear that the two meal mixtures are of practically equal value at the prices mentioned.

III. — Cattle Feeding Experiments.

Experiment A. — Cattle on grass.

This experiment has been conducted at 14 centres with two lots of 62 cattle each. Lot 1 received a mixture of home-grown concentrated foods, whilst lot 2 received a corresponding quantity of imported foods.

The mixture were made up as follows :

Home-grown.

- 1 part wheat meal.
- 1 ½ parts barley meal.
- 2 parts ground oats.

Imported.

- 1 part maize meal.
- 2 parts undecorticated cotton cake.

At the beginning of the experiment 3 lbs. of the above mixtures were given per head daily; this amount was afterwards increased to 4 and finally to 5 lbs. towards the end of the fattening period. The average duration of the experiment was 79 days.

The results are set forth in Table IV.

TABLE IV.

Food.	Price per cwt.	Quantities.	
		Lot 1.	Lot 2.
		cwt. lbs.	cwt. lbs.
<i>Home-grown:</i>	<i>s. d.</i>		
Wheat meal.	8 0	43 60	— —
Barley meal.	7 0	65 34	— —
Ground oats.	6 8	87 8	— —
<i>Imported:</i>			
Maize meal.	7 6	— —	65 34
Uncorticated cotton cake.	6 6	— —	130 68
<i>Cost of food:</i>		<i>£ s d</i>	<i>£ s d</i>
Concentrated.	— —	69 5 10	66 18 9
Grazing.	— —	69 19	69 19 5
Total.	— —	139 8 3	136 18 2
Manurial value.	— —	7 3 7	13 2 3
Total cost of food less manurial value.	— —	132 1 8	123 15 11
Total increase of live-weight.	— —	117 cwt. 102 lbs.	117 cwt. 102 lbs.
Cost of producing one cwt. live-weight increase.	— —	£1 2s 5d	£1 1s 5d

The average results of these experiments show that the increase in live-weight made by the two lots of cattle was identical, but the cost of production was somewhat in favour of the imported foods.

Experiment B. — Stall-fed cattle.

This experiment was carried out at 21 centres with 176 cattle in 2 lots. Lot 1 received the same home-grown foods as in the preceding experiment, whilst lot 2 received a mixture of 1 part decorticated cotton cake and 2 parts maize meal. At 15 centres, part of the decorticated cotton cake was replaced by linseed cake during the finishing period.

At the beginning of the experiment 3 lbs. of concentrated food were given daily, and this quantity was gradually increased, until in some cases as much as 10 lbs. were supplied. The average duration of the experiment was 82 days.

The results are set forth in Table V.

TABLE V.

Food.	Price per cwt.	Quantities.			
		Lot 1.		Lot 2.	
	s. d.	cwt.	lbs.	cwt.	lbs.
<i>Home grown:</i>					
Wheat meal	8 0	90	54	—	—
Barley meal	7 0	135	81	—	—
Ground oats	6 8	180	108	—	—
<i>Imported:</i>					
Maize meal	7 6	—	—	271	50
Decorticated cotton cake	9 6	—	—	144	25
Linseed cake	10 6	—	—	21	56
<i>Bulky food:</i>					
	per ton.	tons. cwt. qrs.		tons. cwt. qrs.	
Roots	8 0	256	1 3	256	1 8
Hay	40 0	26	5 2	26	5 2
Straw	30 0	14	8 3	14	8 3
<i>Cost of food.</i>					
		£	s d	£	s d
Concentrated	— —	144	0 5	167	6 6
Bulky foods	— —	176	12 9	176	12 9
Total	— —	320	13 2	343	19 3
Value of manure produced	— —	14	18 1	26	12 0
Cost of food less manurial value	— —	305	15 1	317	7 3
Total live-weight increase	— —	112 cwt. 40 lbs		118 cwt. 72 lbs.	
Cost of producing 1 cwt. of live-weight increase	— —	£ 2	14s 5d	£ 2	13s 6d

The average live-weight increase was one-tenth pound per head daily in favour of the imported foods, and the cost of production per cwt. live-weight increase was 11d in favour of the imported foods.

Considered as a whole these experiments show that for all practical purposes no superiority can be claimed for either class of concentrated foods at the prices quoted.

The writer received from M. Debruil, of Melun, France, a pair of fowls which were the offspring of a male Silky and a female Duckwing Yokohama; the cross had been made in the hope of obtaining birds combining the texture of feathers of the Silky with the length of feathers of the Yokohama, with a view to using the feathers as substitutes for

"ospreys", etc., the writer bred from these two birds to study the inheritance of the characters involved.

The characters of the parent birds were: *Silky* (male), dark-fleshed, white, with short silky feathers, rose comb, five-toed, with feathered legs and a small crest; *Yokohama* (female), white-fleshed, Duckwing, with long normal feathers, a single comb, four-toed, clean legs and no crest.

The two birds of the F_1 generation were uniform (sex excepted) and showed a practically complete dominance in almost all cases, *e. i.* dark fleshed, coloured plumage ("black-red"), normal feathering, long-tailed (especially in the male), clean legs, crested. The carriage of the tail-feathers was intermediate between that of the parents. The male had five toes and the hen only four.

The F_2 generation is considered in two groups. The first group, consisting of 96 individuals, deals only with those characters such as colour of flesh and feathers, simple or rose comb, 4 or 5 toes, which are visible at birth and on which statistics concerning all the chickens hatched are available. Of these 66 pigmented flesh and 30 non-pigmented; 71 were coloured and 25 white, (expectation 72:24) but very few were pure white; the majority showed some red pigmented feathers on the saddle, the coloured portions being sharply divided from the rest. It is evident that these chickens are not pure recessives but contain a certain amount of pigment. 30 chickens hatched from eggs of these individuals showed the same characters, giving no really coloured ones. The writer suggests that this form of coloration is the initial stage of the "pile" type of coloration found in other breeds of fowls.

No "Duckwing" character appeared in the F_2 generation, all the individuals being of the "black-red" type, but of two kinds, one having black breasts with a few red feathers, the other red breasts with a few black feathers.

With regard to character of comb, 83 had rose combs and 13 single combs. The ratio of five-toed individuals to four-toed was 64:32. The inheritance of both these characters was complicated by intermediate forms.

The characters of the second group, *viz.* silky or normal feathering, long or short feathers, clean or feather legged, crested or not, were studied in 24 individuals reared to maturity. Of these 18 were normal and 6 silky. The flight feathers and tail feathers are only silky at their ends and practically normal at their bases. The length of feathering is difficult to determine and apparently not inherited in a strictly Mendelian manner. No two birds were alike in this respect, but the writer by adopting a provisional standard, divided the birds when six months old into two groups of 19 long and 5 short, thus showing that the long-feathered type is dominant. The real character which determines the length of the feather is the growing period of the feather follicle and this is undoubtedly influenced by the food, environment and individual vigour of each bird, so that when this character is blended with the normal it is only to be expected that the actual length of feather in the progeny would be largely dependent on the indi-

vidual when the environment remains constant. Sixteen individuals were clean-legged and 8 feathered, but, of the 8 feathered ones, 4 were only half feathered and therefore almost certainly heterozygous, thus giving 20 dominants and 4 recessives. The crest was developed in these crosses, being present in 21 individuals and absent in only 3.

Thus, the Mendelian expectations with regard to each character have been largely realised. The writer remarks that recessives are more frequent among females, owing to the absorption of more of their initial vigour, on their sex, and that recessive characters more usually associated with the female can be produced in males by an artificial reduction of vigour. Also if colour may be to a certain extent an indication of vigour, we shall expect to find a higher percentage of recessive characters among white birds than among the coloured ones.

Of these 24 birds, 10 were males and 14 females, 19 coloured and 5 white.

The 10 males showed 13 recessive, 6 heterozygous and 6 dominant characters; the 14 females showed 24 recessive, 14 heterozygous and 42 dominant characters. The 19 coloured individuals showed (excluding the white or coloured as characters) 22 recessive, 14 heterozygous and 133 dominant characters; the 5 white individuals showed 10 recessive, 6 heterozygous and 19 dominant.

These results show that on the average the females have 0.41 more recessive characters than the males, and the whites 0.74 more recessive characters than the coloured.

The writer therefore concludes that the Mendelian proportions are to a certain extent affected by vigour and that it is practically possible to increase the number of individuals possessing a certain character by attention to such details as the food, temperature, age of the breeding stock and time of year at which breeding takes place.

926 - Studies on Inheritance in Pigeons: Hereditary Relations of the Principal Colours. — COLE, L. J., in *Agricultural Experiment Station of the Rhode Island State College, Bulletin No. 153*, pp. 313-380 + 4 plates. Kingston, R. I., May 1914.

These investigations were begun at the Rhode Island Agricultural Experiment Station in 1907, to determine the mode of inheritance of coat colour in birds. Previous work on inheritance in birds (fowls and canaries) has not given data as definite as in the case of mammals. In the case of fowls this was undoubtedly due to the complications introduced by coloured patterns originating in different colour schemes for each feather. Pigeons have been chosen because it is possible to select strains of uniform colour and free from pattern complications.

In most of the studies with fowls, crosses were made with very different breeds showing very marked differences in a large number of characters, thus resulting in confusion. The writer has considered it more advisable to confine his observations to certain well-defined differences in the same breed (Tumblers). It also appeared less probable that similar characters would behave differently in the same breed.

The primary colours of pigeons are : red, yellow, black, brown, blue, silver, and white. These experiments have shown that these colours are produced by only two types of pigment, black and red. Red is the fundamental colour of pigeons and probably also of fowls and the majority of mammals. The red factor is always present, but it only determines the colour of the bird in the absence of an inhibiting factor or of a dominant factor such as the factor for black. For the full manifestation of these two colours an intensifying factor is necessary. When this factor (I) is absent, the colour is of a lighter shade and red becomes yellow, whilst black becomes dun. The I factor is definitely sex-linked in its inheritance. "Duns" are easily obtained by crossing birds having the B factor with birds lacking the I factor, e.g. black \times yellow.

Thus, mating a yellow cock (bbii) with a black hen (BBii) heterozygous for I, will produce black cocks and dun hens, since the factor I is limited to the males. In the reciprocal cross all the F_1 generation will be black and duns will appear in the F_2 generation.

The blue colour of the wild pigeon (*Columba livia*) is due to the optical effect of black pigment aggregated into clumps. In the black birds the pigment is uniformly distributed. This is accounted for by supposing the presence of a spreading factor (S), the absence of which results in the blue colour. Silver colour is regarded as a diluted blue and is therefore black minus the factors I and s. White is due to the absence of pigment and the reflection of light. Pure whites are fairly common but rarely breed true, and the mode of inheritance is very complex. Colour is dominant over white but not entirely. Pure white should undoubtedly be considered as the extreme reduction of mottling. As a provisional hypothesis white may be considered as due to the presence of an indefinite number of factors preventing the formation of pigment. Thus the quantity of white depends on the number of these factors present.

The marking of the plumage of pigeons may be of the following types: 1) splashes or intermingling of white and coloured feathers without definite patterns; 2) special patterns, i. e. a combination of white and coloured areas forming a more or less definite marking; 3) check, light triangular markings on the wings; 4) grizzling, i. e. barbs partially white and partially coloured; 5) mealiness, due to the whole or partial replacement of white by red; 6) frosting, due to the presence of white distal margins on the contour feathers.

It is possible that a particular portion of the plumage may be represented by homozygous factors, such as W_1 , W_2 , etc.

The frequent reappearance of the blue colour of the wild rock pigeon (*Columba livia*) is due to the recurrence of the particular combination of factors present in this type.

In the experiments on the dominance of black over red, the F_2 ratio was nearer 2:1 than 3:1. This was not due to the absence of homozygous dominants, but rather to the tendency toward the production of different ratios in different families or strains. All the results show a slight excess

of red offspring above the normal expectation of a pure dominant and recessive.

In the experiment on the inheritance of the I factor the crossing of heterozygous individuals always gave the 3: 1 ratio; the cross between the heterozygous F_1 and the recessive parent always gave the ratio 1:1, thus showing that the factor for intensification of colour segregates in a strictly Mendelian fashion.

Various matings between birds of different colours gave results according to expectation. In general the offspring tend to be grouped around the parental mean with respect to amount of colour in the plumage. The evidence points to the conclusion that a number of factors are concerned in the production of white and splashed birds.

STOCK RAISING :
ORGANIZATION
AND
ENCOURA-
GEMENT

927 — **Animal Husbandry in Sardinia in Connection with Environment.** — DORIA, MARIO, (Director of the Royal Horse-Breeding Station of Ploaghe) in *Il moderno Zoiatra*, Series V, Year III, No. 7, pp. 313-326. Bologna, July 31, 1914.

In Sardinia, where agriculture is still mostly extensive, live stock is the most important source of income. The animals are generally bred wholly in the open.

Horses. — The Sardinian horse, descended from African and Asiatic breeds, has had a period of celebrity, which came to an end chiefly through too close in-breeding. According to the writer, when the State founded the stallion depots and stations, a great mistake was made in not taking the native horse into account, and of using among others English stallions; these increased the stature of the animals but at the expense of their muscle and the harmony of their shape. The cross of the Sardinian (Oriental) with the English horse has led to a great variation of forms, so that no uniform local breed exists. The horses of Gallura and of Anglona have most English blood, and form a distinct type. According to the writer the stallions to be adopted for the improvement of Sardinian horses should be of pure Oriental breeds, which, like the native Oriental crosses, have the advantage also of being better stock getters than the English stallions.

Cattle. — Cattle breeding has made much progress of late years in Sardinia. There are three breeds of cattle in the island: the plain breed, imported from Sicily, the Schwytz (brown variety) on the hills and in the best pasture lands; the Sardinian or mountain breed, which has remained in its primitive state, not having been subjected to any crossing. It inhabits the mountains especially of Gallura, of the Fonni plateau and of Fonni, Orgosolo and Aritzo. The plain breed lives in the so-called *planargia* and the Campidano towards Oristano; it is especially suitable as a draught animal; the meat is good, but not much sought after on the markets. The small mountain breed is a good draught animal for rough and stony localities; it does not yield much milk; its flesh is excellent, though but little streaked with fat. The Schwytz breed has given origin to the Swiss-Sardinian breed, which is raised all over the island and gives excellent products, as for instance at Oristano, Macomer, Ozieri, Nulvi, Ploaghe, Mores, Bonorva, etc. The Schwytz breed has proved the best for the improvement of Sardinian cattle, though the excess of new blood, if not accompanied by improve-

ments in the pastures and in the treatment, sometimes causes stunted development and a decrease in the yield of meat and milk. For this reason the writer deprecates the use of a pure-bred bull beyond the third or fourth generation, after which cross-bred bulls should be used unless special reasons suggest recourse to a pure bull again.

Sheep. — Grazing is the most important industry in Sardinia. There are two breeds in the island, one in the plains and the other in the mountains. On the plateau of Bitti and in the districts of Fonni, Orgosolo, etc., there is a small hardy breed with roughish and short wool, which does not yield much milk; it passes the winter in the plains or on the hills. In the hills and in the richest pastures the sheep are a cross derived from the mountain breed and the Campidano breed, which is only an importation from Algeria, Tunis and the plains of Apulia. It is bred pure in the fine plains of the Campidano of Oristano. The introduction of a certain amount of the blood of this breed into the mountain breed produces sheep of a suitable stature, yielding good wool and flesh and a fair quantity of milk (an average of 1 ½ to 2 pints per day in spring and in favourable winters). Further crossing gives a much larger sheep which yields more meat but at the expense of the yield in milk and wool. It would therefore be advantageous to practice alternate crossing, that is using Campidano or Apulian rams for two or three generations and then cross-bred rams.

Pigs. — Pig breeding is also flourishing in Sardinia; it is chiefly a small industry of the poor, but there are also extensive herds on the mountainous and wooded parts of the island. The principal pig-breeding centres are Bono, Bolotana, Silanus, Monti, Buddusò and the Gallura region, which is also mountainous and rich in woods. Pig breeding is practised more or less all over the island. In the chief centres the local breed has been crossed with the Caserta, the Verona and Yorkshire crossbreds. Such pigs are frequently met with in the cuntry about Ozieri, Mores, Pattada, Nulvi and Ploaghe. The Sardinian breed still bears a considerable resemblance in build to the wild boar; crossing it with other breeds has much improved its flesh, increased its weight and caused measles to disappear from many herds. The crosses at the age of two years weigh 440 to 550 lbs. dead weight; the pork and hams are excellent. The pigs are fed on butter-milk, whey and bran up to the age of five or six months, after which they are tied up in sties to be fattened. Sometimes the want of exercise and cleanliness causes a form of rheumatic arthritis, on the appearance of which the animals have to be slaughtered immediately.

928 — **Report of the Dickinson County Cow-Testing Association: Results of the First Year** — REED, O. E., in *Kansas State Agricultural College Experiment Station, Circular No. 35*, 8 pp. Topeka, Kansas, 1914.

CATTLE

The records of the Association contain a complete account of the performances of 134 cows during a period of 12 months. The average annual production of these cows was 6019 lbs. of milk and 246 lbs. of butter-fat, while the average Kansas cow produces only 100 lbs. of butter-fat. The average cost of feed was \$ 35.59 per cow per annum and the value of the butter-fat produced was \$ 90.48, leaving a net profit per cow of \$ 54.89.

assuming that the calf and manure produced are liberal compensation for the labour and risk.

The best cow (a Holstein) produced 546 lbs. of butter-fat in 11 months; the poorest cow in the same herd produced only 175 lbs. of fat, whilst the poorest cow in the Association produced only 59 lbs. at a cost of \$ 33.23. The ten best cows made an average profit of \$ 96.43, which is more than six times the average profit made by the ten poorest. With one exception, the ten best cows were dairy-bred animals, while there was only one of the ten poorest that showed any trace of dairy blood in its pedigree. The ten poorest cows made an average of only 119 lbs. of butter-fat for the year, at a profit of \$ 15.23. The profitableness of these poor cows appears still less when one considers that most of them calved in the spring and produced milk only while on grass, thus greatly cheapening their rations. Further, the value of the calves and manure from this batch of cows would not fully compensate for the labour expended, while in the case of the ten best cows it would be an additional source of profit.

Some of the cows with low records of milk production were handicapped by being allowed to remain dry several months of the year and are capable of much better performances under better conditions. It is generally true that many good milch cows are allowed to go dry longer than is necessary and it should be borne in mind that a cow returns the greatest profit when kept in milk throughout the greater part of the year.

SHEEP

929 - **The Breeding of Karakul Sheep in the United States** (1). — YOUNG, C. C., in *The Journal of Heredity*, Vol. V, No. 4, pp. 170-178 + 3 figs. Washington, April 1914.

The first importation of Karakul sheep into the United States was made in 1909, when the writer brought 10 ewes and 5 rams from Bokhara to Wichita Falls, Texas. In 1913 a second batch of 17 was received from Central Asia. Of the first importation only two gave birth to lamb which had thick curly fleeces. The writer found that among the imported sheep and rams, some had thick coarse fibres in their fleeces whilst others had a layer of short fine, reddish wool under the fleece, which was without gloss and resembled Merino wool under the microscope. The animals imported from Bokhara gave lambs with thick curly fleeces, whilst the lambs belonging to the second importation had open fleeces worth little more than fur. The writer is of opinion that the fineness of the wool of the latter group of sheep is due to admixture with some Afghan breed possessing fine wool, and he proposes to call them the Afghan Karakul breed. It is easy to eliminate the fine wool characters in one or two generations by using a ram entirely free from fine wool.

Crosses between Karakul rams and Merino and Shropshire ewes do not produce good fleeces, but good results were obtained with Lincoln Longwool crosses and with red fat-tailed Persian sheep (*Ovis montanus*), which are free from short wool. The Persian sheep only produces curly-wooled lambs when crossed with the Astrakhan breeds and its wool is wrongly classed as fur in commerce.

(1) See also No. 282 B. March 1913; No. 653 B. July 1914.

(Ed.).

There are six classes of sheep in Central Asia called Karakul by the Russians, and Arabi by the inhabitants of Bokhara, and they all derive the black pigmentation, the tendency to close curly wool and their glossy fleeces, from the small black Danadar sheep, now almost extinct.

These are: 1) the Large Arabi or Duzbai sheep; 2) Small Arabi; 3) Medium Arabi, a hybrid between 1 and 2; 4) Grey Shiraz; 5) Zigois (these five classes are not very numerous); 6) Afghan Karakuls, which unfortunately constitute 90 per cent. of the fur classes of Bokhara, since, though they are hardy and produce excellent flesh like the other races, they only yield a fur of inferior quality unless crossed with rams of the other breeds. The small Arabi is the best breed and the Duzbai is quite satisfactory and makes a good cross with our common sheep, increasing the weight and improving the quality of the flesh. The writer is of opinion that the Afghan sheep is the ancestral form of the Merino.

Sheep imported from Bokhara, besides being seldom free from fine wool, are too often inbred, since they come from small districts in the neighbourhood of railway stations (Tjardjui, Kara-Kul, Bokhara). The Karakul sheep imported into Russia, Germany and Austria are of very small value.

930 - The Age of Goats according to their Teeth. — SCHEUNPFLUG, in *Berliner Tierärztliche Wochenschrift*, Year 30, No. 28, pp. 503-504. Berlin, July 9, 1914.

GOATS

Most of the data at present available on the age of goats according to their teeth present considerable discrepancy and do not correspond to actual facts, for, as the present investigation proves, the appearance and the replacing of the teeth takes place generally earlier than the above data state.

According to the observations of Dr. Scheunpflug the central incisors are replaced at 14 to 16 months; goats which have their central permanent incisors up are, as a rule, upwards of one year old and seldom upwards of 23 months.

The 2nd pair of incisors change in general at 19 to 22 months. Goats that have their 2nd pair of permanent incisors up are above 17 months old and but rarely over 34 months.

The 3rd pair are replaced mostly at 21 to 26 months and generally between 23 and 24 months. After the 3rd pair of permanent incisors are up the animals are, as a rule, above 19 and under 36 months old. Exceptionally however they may be older.

The corner incisors are generally replaced at between 29 and 38 months, most frequently between 32 and 36 months and in some cases even later than 38 months. Goats with the corner permanent incisors up are mostly upwards of 28 months old. (In judging the age by the jaws of dead animals the appearance of the third molars has also to be taken into consideration, as well as when only the first three pairs of permanent incisors are up).

In most cases the permanent teeth are all up at 2 $\frac{3}{4}$ to 3 years.

In practice, in judging the age of goats by their incisors it may be assumed that in general the central pair are replaced at the age of 1 $\frac{1}{4}$

years, the 2nd pair at $1\frac{3}{4}$, the 3rd pair at 2 and the corner pair between $2\frac{3}{4}$ and 3 years. Thus the intervals between the replacement of each pair of incisors are about 6 months, about 3 months, and 9 months (more precisely from 6 to 12 months) respectively.

It sometimes happens that the two permanent incisors of a pair do not appear at the same time; if only one is up, the age, should be reckoned a month less than if both are up.

The lack of permanent incisors, especially of the central pair, is in most cases due to oligodonty, which in some localities has been frequently observed.

In determining the age by the jaws of dead animals valuable data are furnished by the molars also, all the more so as the periods of their appearance and replacement in goats have a more restricted range than is the case with the incisors.

According to Dr. Scheunpflug the appearance of the molars in the lower jaw generally precedes that in the upper jaw. At the age of 3 months the first molar appears in the lower jaw and at 4 months the corresponding tooth in the upper jaw.

At the age of $5\frac{1}{2}$ months the first upper and lower molars are in wear. In some cases the second molars pierce through the gums in the lower jaw shortly before the eighth month, as a rule however, between 8 and 9 months, seldom later. In the upper jaw they appear between 8 and 10 months.

At 12 months the second molars are in wear. The change of the premolars takes place at from 17 to 20 months and at the same time in the upper and lower jaws. Sometimes one temporary molar is cut first, sometimes the other, as the replacing depends only upon accessory circumstances.

After the replacing of the above temporary molars, in general after these are in wear, the third molars are cut. They appear between 18 and 21 months, apparently a little later in the upper jaw than in the lower one.

All the third molars are up at between 18 and 24 months, and in wear not before 26 months. At the cutting of the third molars, it must be noted, in general the 2nd and sometimes the 3rd pair of incisors are replaced.

Oligodonty of the molars was observed by the writer only in the 3rd pair.

The data found in the literature on the replacing of the teeth in sheep are compared with the writer's observations on goats. It appears that the termination of the period during which the incisors are replaced is nearly the same in goats as in early-maturing sheep (especially according to the data of Cornevin and Lesbire). There is nevertheless a small difference in that the period between the replacing of the first and second pairs of incisors in sheep is about two months shorter than in goats. On the other hand the interval between the 2nd and 3rd pairs is shorter in goats.

The temporary molars are certainly replaced earlier in goats than in sheep, as, according to the writer, the premolars are replaced in goats

shortly before the cutting of the third molar, while in sheep this happens only after the cutting of the latter or at the same time.

931 - The Rearing of Reindeer in Alaska (1). — CHUBBUCK, LEVI (Office of Farm Management, Bureau of Plant Industry, U. S. Department of Agriculture), in *The Journal of Heredity*, Vol. V, No. 4, pp. 149-154 + 3 figs. Washington, April 1914.

REINDEER

The introduction of the European reindeer into Alaska was recommended by Prof. S. F. Baird in 1851, notwithstanding the fact that the indigenous American caribou is capable of domestication. This suggestion was also made by Townsend in 1867, and in 1892 Dr. Sheldon Jackson, agent-general of the Bureau of Education in Alaska, introduced a small herd of domesticated European reindeer, which was followed by others. As a result of breeding, their number now reaches 40 000 and has transformed the native people from hunters and fishermen to herdsmen.

The reindeer indigenous to North America are: *Rangifer arcticus* (Barren-ground Caribou), inhabiting the extreme north, and *R. caribou* (Woodland Caribou) in the wooded region south of the former. This latter species differs slightly from that of the old world (*R. tarandus*). Apparently no attempt has been made to domesticate it, though it is fertile when crossed with the domestic reindeer; this character is valuable, since the native species are larger and stronger than the imported species which appears to show signs of degeneration. The present area of undeveloped land in Alaska that would be suitable for rearing reindeer is estimated at 100 000 square miles, capable of supporting 10 million deer. The most suitable region is north of the Yukon river. The reindeer lichen (*Cladonia rangiferina*) occurs throughout the arctic region of Alaska, in the Seward peninsula, in the tundras of the west and in the mountains of the Alaska chain and of the Alaska peninsula.

Reindeer do not require shelter; in fact they require no care beyond watching. Almost half of the present herds are in the Seward peninsula and the remainder are distributed as far as Point Barrow on the Arctic Ocean in the Alaska peninsula and to Tanana towards the Yukon river. They belong to Eskimos, Indians and a few Laplanders; the latter were brought over with the animals by missionaries to teach the care of the reindeer. Some herds belong to the Government. The Alaska Division of the U. S. Bureau of Education, Department of the Interior, looks after all the herds, through the masters of the Government native schools.

In 1911 a hundred carcasses were sent from Nome to Seattle and sold for 75 cts. per lb. Up to the present the Alaska markets have consumed all the reindeer flesh which is produced. A dressed carcass averages about 130 lbs. in weight; the butcher buys the dressed carcasses at about 25 cents per lb. The most suitable age for slaughtering the animals is 7 or 8 years, i. e. after they have been worked for 5 or 6 years. The cows are rarely milked in Alaska; any milk obtained is consumed fresh after dilution with water or as cheese; butter is never made, since the fat has a rancid flavour. There is a heavy loss amongst the young animals ow-

(1) See also No. 1186, B. Oct. 1913 (Reindeer in Newfoundland).

(Ed.)

ing to the unscientific method of rearing introduced by the Laplanders and the tundra fires, so that the rate of increase of the reindeer is only half that of herds of cattle.

POULTRY

932 - Winter Egg Records in Ireland.— *Department of Agriculture and Technical Instruction for Ireland, Journal*, Vol. XIV, No. 3, pp. 546-547. Dublin, April 1914.

The data presented are from records kept in Ireland under the control of the Department.

TABLE I. — Average number of eggs per hen during the six months October to March.

Breed.	1908-09	1909-10	1910-11	1911-12	1912-13	1913-14
White Leghorn	44.3	39.7	41.5	45.1	42.4	47.4
Brown Leghorn	40.7	42.1	37.9	49.3	51.8	38.1
Black Leghorn	—	—	—	—	64.3	—
Minorca	32.8	38.0	48.3	48.3	86.3	60.5
Buff Orpington	54.5	42.4	45.2	42.6	49.1	58.6
White Orpington	50.7	48.7	54.1	52.6	44.1	38.6
White Wyandotte	56.6	34.2	45.2	45.8	42.9	33.9
Faverolle	42.5	41.5	35.7	28.8	42.2	34.9
Plymouth Rock	35.9	39.2	45.5	36.5	43.1	38.8
Ancona	—	—	—	64.9	—	—
Houdan	59.2	58.5	62.5	58.0	75.8	46.4
Andalusian	—	71.3	—	—	—	—
Rhode-Island Red	—	—	63.9	61.9	49.1	48.4
Light Sussex	31.6	32.1	39.8	41.8	38.4	49.7
Red Sussex	—	—	—	—	—	32.5
Mixed pure breeds	39.7	—	—	—	—	—
Mixed breeds	40.8	41.9	40.5	41.6	43.7	42.4
Average	42.3	40.7	42.7	41.8	44.2	42.2

TABLE II. — Variations in different strains of the same breed.

Breeds	Average of all flocks	Average of the best flock	Average of the worst flock
White Leghorn	47.4	75.0	31.5
White Wyandotte	33.9	53.3	22.0
Faverolle	34.9	57.8	21.2
Plymouth Rock	38.8	60.8	20.9
Rhode-Island Red	48.4	59.1	28.7
Light Sussex	49.7	72.4	38.3
Mixed breeds	42.4	78.6	16.0

Omitting the breeds of which the returns relate to less than 100 birds, the following is the order : Light Sussex, Rhode Island Red, White Leghorn, Plymouth Rock, Faverolle, White Wyandotte.

The egg-laying capacity of the different strains of the same breeds varies considerably, as shown in Table II.

933 - Attempts at Breeding the Great White Heron and the Buff-Backed Heron (Cattle Egret) in Madagascar. — GUILHELM, in *Colonie de Madagascar et Dépendances, Bulletin Économique*, Year 13, No. 4, pp. 472-476. Antananarivo, 1913.

With a view to protecting the great white heron and the buff-backed heron in Madagascar, an Order was issued on May 3, 1913, forbidding their being shot in the island. These two species are valuable for their plumage and the second is a very useful bird, as it feeds almost exclusively upon cattle ticks, which often spread contagious diseases. The writer, having observed that the Malagasy kept birds caught young in a state of perfect domesticity, thought of the possibility of breeding them economically. He tried keeping them in cages and fed them with raw meat and fish. His attempts have been successful, and the cutting of the feathers has been found more advantageous than plucking them. M. Guilhelm thinks that breeding these birds would be especially suitable in the northern and north-eastern provinces of Madagascar.

934 - New Research on the Visual Power of Bees. — VON HESS, in *Die Naturwissenschaften*, Year 2, Part 34-35, pp. 836-838. Berlin, August 28, 1914.

The writer reports upon a series of experiments, all of which agree in proving that it is quite out of the question to think that bees have a sense of colour in any way comparable with that possessed by man.

935 - Apiculture in Ireland. — *Daily Consular and Trade Reports*, Year 17, No. 167⁷ p. 342. Washington, July 18, 1914.

The importance of apiculture in Ireland may be judged from the following statistics of production :

	Average 1901-1910	1911
	lbs.	lbs.
<i>In hives with removable combs:</i>		
Run honey	69 291	91 450
Section honey	262 253	422 862
Total	331 544	514 312
<i>In other hives:</i>		
Run honey.	89 123	69 254
Section honey	29 004	27 737
Total	118 127	96 991
Grand total	449 671	611 303

Of the 611 303 lbs. produced in 1911, the two eastern Provinces of Ireland supplied the bulk, Ulster giving 204 784 lbs., while Leinster furnished 181 354 lbs.; the western Provinces (Munster and Connaught) supplied 132 387 and 92 778 lbs. respectively.

The abundance of vegetation and flowering plants has always had a tendency to encourage the production of honey in Ireland.

The usual price paid to producers for comb honey is 9d. per lb., while the retail price is 1d to 2d higher.

Under the Bee Pest Prevention Act (Ireland, 1908) any swarms infected with disease of whatever description may be ordered to be destroyed by local committees of agriculture, with the approval of their respective county councils. Compensation is rendered for all such enforced destruction, and in 1913 the aggregate sum set aside for this purpose was approximately. £ 257.

936 - Collection and Exportation of the Wax of Wild Bees in the African Colonies. —

MICHEL, E. (Agricultural Engineer at the Ministry of the Colonies) in *Bulletin agricole du Congo Belge*, Vol. V, No. 2, pp. 385-395 + 6 figs. Brussels, June 1914.

This paper contains information on the wild bees' honey in the African colonies, a description of the native methods of bee-keeping in the Belgian Congo, in the Sudan and in Tunis, and of the improved methods of separating wax (melting by solar heat, in a stove, in boiling water).

The trade in wild beeswax is constantly increasing in most of the African colonies, especially in Gambia, Gold Coast, Nigeria, Angola, Sudan, Uganda, British East Africa, German East Africa, Mozambique. A few years ago the exportation of wax from these countries was almost insignificant, while now it amounts to thousands of tons. Wax occupies the third place in the export trade of Angola (Benguela supplying 90 per cent. of the exports of the whole province). Angola exports every year 600 or 700 tons of wax; Mozambique about 100; Portuguese Guinea 50. The wax is exported in cakes weighing 253 to 264 lbs. each. The quantities of wax exported during the last few years from German East Africa and from the British African colonies are given by the following table

Colonies	Year	Exports of wax	
		weight lbs.	value £
German East Africa	1911	802 347	40 488
Gambia.	1912	29 498	1 154
Nigeria	1913	12 862	385
Uganda	1912-1913	263 408	—
British East Africa.	1912-1913	139 207	7 522
Nyasaland.	1912-1913	110 609	5 478
Sudan.	1912	12 704	2 270

Wild beeswax when well purified is comparable to European wax. The Central Administration of the Belgian Congo had some samples of wax from the colony examined, and among them many of good quality were found. Bees are widely spread in the Belgian Congo; the natives extract honey but do not make any use of the wax, the value of which is unknown to them.

FARM ENGINEERING.

937 - **Stump Burning to Reclaim "Logged-off Lands"**. — ALLISON, LE ROY W., in *Engineering Record*, Vol. 70, No. 4, pp. 95-96. New York, July 23, 1914.

AGRICULTURAL
MACHINERY
AND
IMPLEMENTS

In the Pacific North-West of the United States there are extensive areas called "logged-off" lands upon which forest trees have been felled and which are now covered with stumps varying from 3 to 6 ft. in diameter, intermingled with a successive growth of trees and underwood.

With proper clearing these logged-off lands are very valuable for agricultural purposes. Many methods have been employed for freeing the lands from stumps, such as grubbing, burning, blasting and pulling.

The cost per acre of clearing lends varies considerably with the character of the subsoil, condition of land, etc., but as an average the following may be taken :

Method	Average cost per acre
Powder and horse puller	\$ 110
Donkey engine.	90
Powder and grubbing	80
Powder and burning	70

A complete land-clearing plant has recently been devised, overcoming some of the disadvantages of the various methods noted and combining most of their advantages. It is known as the Blake land-clearing machine and consists of a five-fire Pluto stump burner, a saw, a power grubber and two stump pullers, the whole being operated by a gasoline engine.

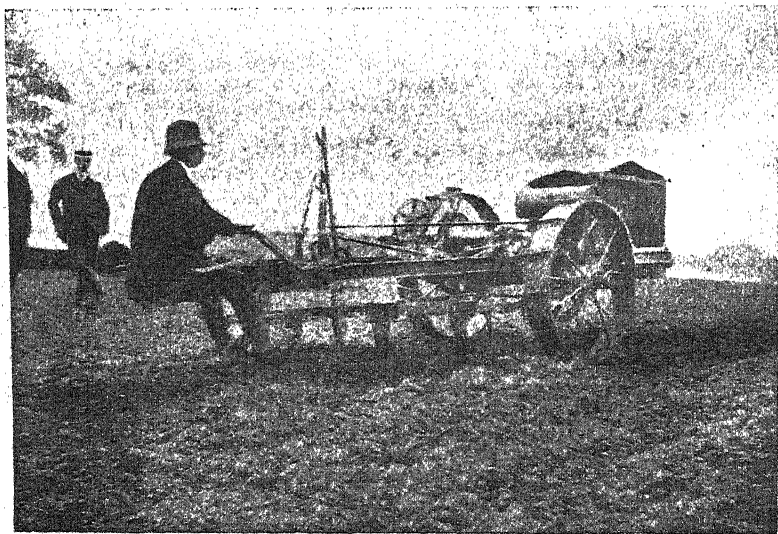
The stump burner is operated by a blower on the machine; a line of pipe connects the blower to a sheet-iron hood, which is made in four sections and is set over the stump to be destroyed. The use of the burner is simple: a hole is bored down through the centre of the stump and a small explosive cartridge is employed to split it apart. This splitting, while not essential, facilitates the fire started at the top of the stump to gain rapid headway. The hood is then placed over the stump and banked up with a little earth at the bottom and forms a closed but not air-tight chamber. The fire is started and the pipe connection from the blower is made, after which a constant downblast is turned on the flame. Stumps are consumed in this manner in from 2 to 4 hours or more according to size. Upon removal of the hood the fire is covered with earth, allowing the roots to charpit to the ends.

Official tests of the burner have been made. During one of them an old water-soaked stump 20 feet in circumference at the base, 13 ft. at the top and 4 ft. high was consumed in 6 hours; the total cost was \$ 1.15, divided into 75 cents for gasoline and 40 for explosives.

The method of operating the whole outfit is to set it in a corner of the land to be cleared : five stumps on the immediate vicinity are split, fired and placed under the blower blasts. Meanwhile second-growth trees are pulled out and sawed into cordwood, the roots and snags burned and the undergrowth and small roots are removed with the power grubber. Subsequently the machine is removed to another position and these operations are repeated. By this method a strip of 50 to 100 ft. wide is left ready for plowing and seeding while the outfit is engaged clearing other sections, the whole work being done rapidly at a reduced cost and without waste of the valuable vegetable mold.

938 - **The Garrett-Crawley Agrimotor.** — *The Implement and Machinery Review*, Vol. 40, No. 471, p. 375. London, July 1, 1914.

At the Suffolk Agricultural Association's show, held at Bury St. Edmunds on June 4 and 5, a new tilling machine, the Garrett-Crawley Agrimotor, was shown at work. As can be seen from the accompanying figure



Garrett-Crawley Agrimotor.

it is self-contained and controlled by one man from a seat in the rear. The petrol-driven engine which is situated in front nicely balances the plough shares at the back, so that at the end of the furrow the operator may leave his seat and turn the machine round in its own length on either of the travelling wheels with the utmost ease.

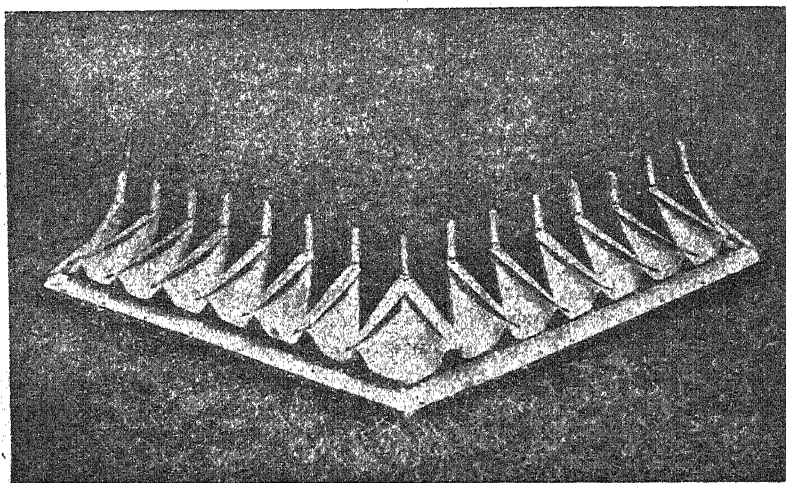
The levers for regulating all the movements of the apparatus are within reach of the operator, one being provided for lifting and lowering the plough and others for declutching either of the wheels, for going forward, stopping or backing, besides a handle for steering. The engine is of 25 H P; it runs at 1 000 revolutions per minute and can turn over 1 $\frac{1}{2}$ acres per hour to a depth of 5 inches.

When ploughing, one of the road-wheels is raised by means of a hand wheel and worm as high as the depth of ploughing required, while for travelling along a road the plough can be raised by the adjustment of a castor wheel below the driver's seat.

Although primarily a plough, any other farm implement may be attached to and worked by the agrimotor.

939 - The "Welsh" Bracken Cutter. — *The Implement and Machinery Review*, Vol. 40. No. 471, p. 390. London, July 1, 1914.

One of the newest implements for the control of bracken is Welsh's bracken cutter. As will be seen from the accompanying figure it consists of a V-shaped frame carrying 15 runners turned up in front, shod with



The « Welsh » Bracken Cutter.

steel and fixed together at the rear by a specially tempered steel plate. The curve given to the front of each runner, together with its individual flexibility, makes easy the "jumping" of any obstruction; the cutting blades and guide plates are so fixed that every bracken stalk which finds its way between the runners is sliced down. The frame, too, is flexible

to enable the machine to keep in close contact with the ground. The implement weighs 1 cwt., is 6 ft. wide and is easily drawn by a horse or pony.

Three or four cuttings may be required the first season and two or three in each of the next three years.

940 - **The Articulated Yoke.** — MANREN, G., in *Journal d'Agriculture Pratique*, Year 78, Vol. 1, No. 23, pp. 719-722. Paris, June 4, 1914.

M. A. Guérineau's yoke, exhibited at the last Paris Agricultural Show, presents the advantage of maintaining the usual way of fixing the double yoke to the poles of vehicles or to draught chains and at the same time allowing a great freedom of movement to the head of each animal.

The yoke consists of two head-pieces, *A*, *B* (see figs. 1 and 2), of the single-yoke type jointed to the cross-piece *C* which carries the draught gear *T* for the pole or chain.

The head-piece is placed on the neck of the bullock and is attached to the horns with the usual thongs.

In the middle and on the top of each head-piece is fixed a plate, *a* (see section, fig. 3), the top of which bears a pin, *b*, on a turning joint allowing the pin sufficient play to describe an inverted cone; the upper part of *b* is a screw carrying the nut *e*, which causes the counter-plate *c* to press moderately against the plate *a*, allowing a certain amount of play. The plate *c* is strongly fixed by the bolts *d* to the cross-piece *C*. When the nut *e* is in a suitable position, it is fixed there by a hinged piece, *h*, fitting on the square extremity of the pin *b*.

It will be seen in figs. 1 and 2 that the upper surface of the plate *a* is flat, while the under face of plate *c* is a segment of a sphere, thus allowing the pin *b* to move on its turning joint. Fig. 2 shows that plate *a* bears two projections, *n*, *n*, and that the corresponding gaps, *m*, *m*, in plate *c* of the cross-piece *C* are somewhat larger than the projections, so as to allow them play-room and to permit the cross-piece *C* to assume an oblique position in the horizontal plane. The result is that the heads of the oxen enjoy a relative freedom of motion both in the vertical and horizontal directions and independently of each other.

The draught gear, *T*, can be shifted along the cross piece, *C*, so that when animals of different strength are harnessed together the weaker one can be given some relief by the longer lever-arm.

This yoke costs about 31s. It weighs only about 33 lbs., or about 11 lbs. more than the usual yoke.

941 - Review of Patents.

Tillage machines and implements.

Austria	66 122. Weeding machine.
	66 134. Coulter-holder for ditching ploughs.
	66 253. Device for regulating the depth of work of gang ploughs.
	66 263. Apparatus for ploughing-in all kinds of manures by ploughing machines.
Belgium	264 848. Device for fixing the extensible axle in the fore-carriage of ploughs.
	264 850. System of fixing the adjustable point of ploughshares.
	265 027. Plough.

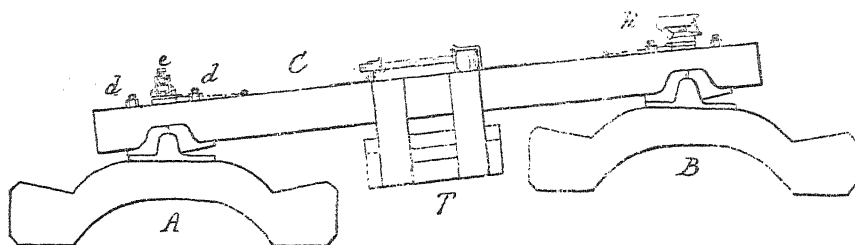


Fig. 1.

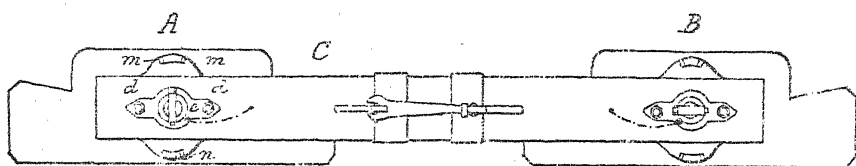


Fig. 2.

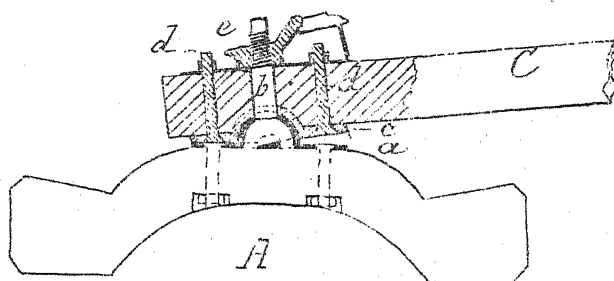


Fig. 3.

GUÉRINAU's. — Articulated Yoke.

- Canada 153 923. Plough coulter.
- Germany 203 626. Tilling implement with harrow teeth and hoes.
 273 777. Motor tilling machine with spades turning sideways also.
 273 907. Turn-wrest plough with revolving beam.
 274 129. Turn-wrest plough.
 274 141. Driving wheel for motors, especially for ploughing.
 274 435. Plough with jointer.
 274 436. Plough for motor traction.
- Hungary 63 459. Balance plough.
 63 509. Plough with revolving screw in front of share.
 63 521. Implement for hoeing and rolling between rows of beets.
 63 601. Turn-wrest plough.
 63 656. Hoeing and banking machine.
 64 631. Rotary digger.
 63 686. Motor plough.
 63 719. Horse-hoe.
 63 777. Electric auxiliary apparatus for two-engine ploughing.
 64 114. Cultivator hoes.
 64 214. Gang plough.
 64 243. Hoes for rotary diggers.
 64 307. Fork-like supports for mouldboards.
 64 346. Apparatus for machine ploughing.
 64 414.)
 and) Improvements in motor ploughs.
 64 436.)
 64 430. Motor windlass for ploughs.
 64 506. Harrow.
- Italy 140 763. Improvement in tractor ploughs.
 134 426. Tillage machine.
 140 516. Improvement in the driving of windlasses in machine ploughing.
 140 369. Rotary digger.
 153 755. Pulifici's new system of haulage for ploughs.
 141 143. System of lubricating ploughshares with water, or water mixed
 with other substances, by means of the hollow bolts which
 fix the share and mouldboard to the body of the plough.
 141 594. Improvement in disk harrows.
 136 513. Innovations in ploughs.
 140 406. Tractor for ploughs with steering wheel or system of steering
 wheels situated in front of driving wheel.
- United Kingdom 1 816. Motor ploughs.
 2 400. Motor plough hauling itself along a rope anchored at both ends.
 3 455. Weeding and cultivating machines.
 3 458. Land rollers.
 3 578. Cultivating machine for digging or pulverizing land.
 3 651. Land-cultivating machine.
 3 966. Ploughs.
 4 496. Rotary tool for cultivators, etc.
 5 254. Spade, shovel and fork handles.
- United States 1 097 908. Pulverizing and smoothing harrow.
 1 099 080. Potato hiller and weeder.
 1 099 877. Adjustable subsoiler attachment.
 1 099 304. Cultivator shovel.

- 1 099 897. Ploughshare.
- 1 100 395. Pulverizing implement for the treatment of fallow and other land.
- 1 100 620. Deep tilling attachment.
- 1 100 938. Sulky plough.
- 1 100 988. Five-horse cultivator equalizer.
- 1 101 348. Gang plough.
- 1 101 158. Plough coupling.
- 1 100 920. Subsoil plough.
- 1 101 777. Hitch for gang ploughs.

Manure distributors.

- Canada 153 402. Manure spreader.
- 153 453. Fertilizer distributor.
- France 468 069. New manure spreader for vineyards.
- Italy 141 770. New manure spreader for vineyards.
- United States 1 098 502. Manure loader.
- 1 099 845. Manure spreader.

Drills and sowing machines.

- Austria 66 138. Feed wheel for potato planters.
- 66 140. Feeding gear for potato planters.
- 66 245. Potato planter.
- 66 254. Drill with force feed and hopper with moveable back.
- Canada 153 399. Double disc attachment for drills.
- Denmark 18 970. Sowing machine for beets, cabbage and beans.
- Germany 274 232. Apparatus for sowing grass seeds.
- Hungary 63 504. Drill.
- 63 661. Attachment for wheels to prepare holes for planting potatoes.
- 64 226. Device for drill hoppers.
- 64 474. Potato planter.
- Italy 140 732. Disk distributor for sowing machines.
- 140 609. Knapsack sowing machine.
- 140 639. Beet sowing machine and manure spreader combined.
- 125 117. Hand sowing machine with distributing disk driven by a cord.
- United Kingdom 2 869. Agricultural drills.
- 5 765. Seed drill.
- United States 1 097 611. Land marker for planters.
- 1 098 416. Sowing machine.

Reapers, mowers, etc.

- Canada 153 448. Binder tractor.
- 153 451. } Binder mechanism.
- and } 153 506. }
- 153 508. Bundle carrier.
- 153 509. Loader for binders.
- 153 523. Harvester mechanism.
- 153 936. Harvester cutting mechanism.
- 153 976. Shocker.
- 153 999. Sharpener for lawn mower.
- 154 006. Shocking machine.
- France 469 569. Universal fore-carriage for harvesting machines.

- Germany 273 728. Tedder with adjustable tine bars.
- Hungary 63 723. Improvements in two-axle motor mowers.
63 788. Mower.
64 023. Mower with circular knife.
64 062. Steering gear for mowing and reaping machines.
64 289. Implement for tying sheaves.
- Italy 138 157. Complete mower cutter-bar with two cutting sections moved in alternate directions and light divider.
140 560. Rotatory mower.
139 881. Sharpener for blades of mowers.
131 477. Side delivery rake.
141 768. Process and apparatus for hardening scythes by compression and curving them.
141 785. Counting apparatus for binders.
- Switzerland 65 865. Canvas for binder.
66 053. Swath rake.
- United Kingdom 1 574. Lawn mowers.
1 751. Harvesting flax.
4 108. Mowing machine swath board.
4 820. Mowing machine.
5 892. }
5 993. } Side-delivery rakes.
6 251. }
- United States 1 097 821. Mowing machine divider rod attachment.
1 097 693. Corn harvesting machine.
1 099 495. Flax and grass seed harvester attachment for mowing machines.
1 099 407. Harvester.
1 099 591. Corn topper.
1 101 393. Sugarcane harvester.
1 101 758. Mowing machine.
1 101 607. Corn gathering and husking machine.
Machines for lifting root crops.
- Belgium 265 299. Potato lifter.
- Denmark 18 875. Beet-topping machine.
- Germany 274 307. Potato lifter with side wheel, one share for cutting the vines, one for lifting the potatoes into a drum-shaped sieve running on the ground.
- Hungary 63 992. Beet topper.
- United Kingdom 1 072. Potato harvester.
4 334. }
and } Potato diggers.
5 178. }
- United States 1 097 990. Potato digger.
1 099 414. Beet topper and harvester.
1 099 643. Beet harvester.
1 101 584. Topping device for sugar-beets.
- Threshing and winnowing machines, etc.*
- Austria 66 121. Cereal husking machines.
- Belgium { 264 857. }
and } Threshing machines.
265 195. }

- Canada 153 796. Thresher.
- France 468 340. Improvements in the mechanical feeders for threshing machines.
- Germany 274 233. Step-shaped caving riddle for threshers.
 63 569. Improvement in threshers.
 63 637. Winnowing and grading machine.
 64 612. Regulator for winnowers.
 64 055. Sack stand for threshers.
- Italy 140 886. Automatic feeder for threshers.
- Switzerland 65 886. Sheaf opener.
 66 314. Apparatus for cleaning, sorting and airing grain.
- United Kingdom 3 663. Threshing machine.
 5 958. Dust-removing apparatus for threshing and other agricultural machines.
- United States 1 098 560. Grain thresher.
 1 098 803. Grain separator.
 1 099 339. Corn sheller.
 1 100 150. Threshing machine.
- Other agricultural machines.*
- Austria 65 908. Ribbon-shaped earmarks for animals and pincers for same.
 66 124. Apparatus for taking electricity from a line for electrically-driven agricultural machines.
 66 244. Motor lorry with windlass.
 66 249. Iron wheel for agricultural machines.
 66 258. Apparatus for hammering scythes.
 66 142. Drive for butter-making machine.
 66 144. Injector.
 66 252. Apparatus for destroying insects.
 66 259. Groat mill.
- Canada 153 403. Tractor.
 153 416. Tractor truck.
 153 433. Straw spreader.
 153 465. Hay stacker.
 153 471. Egg turner.
 153 485. Stump puller.
 153 525. Hay loader.
 153 555. Milking machine.
 153 612. Grain steeping machine.
 153 686. Churn.
 153 800. Butter-making machine.
 153 826. Fruit evaporator.
 153 845. Milking apparatus.
 153 863. Fruit-packing implements.
 153 916. Loader for hay.
- Denmark 18 967. Teat cup.
 18 995. Bruising mill.
 19 002. Mill.
 19 029. Automatic crib.
- Germany 273 569. Apparatus for electric automotor agricultural machines.
 273 729. Apparatus for cleaning and removing rust from chopped fodder.
 273 730. Device for fixing ladders to trees.
 274 140. Three-wheeled tractor with driving fore-wheel for agricultural machines.

- 274 182. Fodder truck with inclined bottom and side apertures regulated by sliding panels.
- 274 183. Automatic feeding device for live stock.
- 274 184. Automatic trapdoor for poultry houses.
- Hungary 63 510. Apparatus for tying bundles of straw, sticks, etc.
- 63 786. Potato peeler.
- 63 805. Apparatus for unloading carts.
- 64 385. Chaff-cutter with fan.
- 64 361. Cabbage and beet slicer.
- Italy 140 419. Improvement in plunger pumps for sprayers.
- 140 913. Machine for cutting the roots of hemp.
- 141 154. Universal grape crusher and must separator.
- 140 894. Process and apparatus for extracting oils by pressure.
- 140 460. Mechanical lifting apparatus for straw elevators.
- 141 707. Yoke.
- 140 175. Automatic jet for water or other liquids.
- 141 937. New sulphurer w th moveable horizontal cylindrical sieve.
- Switzerland 65 867. Moveable hothouse.
- 65 908. Mechanism for dried milk works.
- 65 911. Apparatus for flaying animals.
- 66 054. Automatic loading of hay-carts.
- 66 058. Device in concrete mangers for the watering of cattle.
- 66 117. Apparatus for emptying vacuum milking machines.
- 66 250. Box for conveyance of cattle.
- 66 251. Device for preventing horses from shying.
- 66 312. Apparatus for steriilising milk and other liquids that are easily decomposed by heat.
- 66 313. Apparatus for producing a uniform degree of moisture in cereals.
- United Kingdom 987. Trap nests for poultry.
- 1 015. Portable feeding device for draught animals.
- 1 504. Delinting cotton seed.
- 1 668. Cow milkers.
- 1 672. Fastenings for butter churns.
- 2 028. Apparatus for sterilizing soil.
- 2 069. Appliance for cutting up maize stalks.
- 2 353. Moulding device for making hay ricks, corn stacks, etc.
- 2 766. Apparatus for preparing peat.
- 2 927. Centrifugal separators.
- 3 138. Apparatus for preparing cultures of lactic bacteria.
- 3 193. }
and } Cutters for tapping rubber trees.
- 3 350. }
- 3 248. Hop-picking machine.
- 3 262. Potato grader.
- 3 333. Kneading machine.
- 3 364. Cow milkers.
- 3 534. Butter blender.
- 3 610. Cotton gin.
- 3 830. Milk churn lids.
- 4 202. Cotton-picking machine.
- 4 400. Brushes for killing insects.
- 5 686. Machine for decorticating nuts.

- 5 687. Mill for cracking nuts.
- 5 900. Fruit-picking appliance.
- 6 037. Bale tying-tongs.
- 6 180. Cow milkers.
- 6 183. Egg-testing devices.
- 6 314. Sugarcane mills.
- United States 1 097 887. Grain and seed cleaner.
- 1 097 853. Horse hay fork.
- 1 098 221. Implement for transplanting and replanting small plants.
- 1 097 723. Steering device for traction engines.
- 1 098 602. Baling press alarm.
- 1 098 553. } Hay stackers.
- and }
- 1 099 190. }
- 1 099 088. Tongue truck.
- 1 099 319. Wire fence stretcher.
- 1 099 311. Hay loader.
- 1 099 538. Traction engine.
- 1 099 778. Bean separating machine.
- 1 099 201. Handhold for implements.
- 1 100 123. Draught equalizer.
- 1 100 592. Baling press.
- 1 100 370. Adjustable wagon tongue.
- 1 100 350. Apparatus for raising and lowering vehicle bodies.
- 1 100 908. Cotton picking machine.
- 1 109 968. Grain shock scoop.
- 1 100 950. Fodder cutter discharge-pipe.
- 1 100 970. Windmill oiler.
- 1 101 170. Hay carrier.
- 1 101 543. Windmill.
- 1 101 856. Seed corn tester.

942 - **Pig Sty with Device for Protecting Sucking Pigs and Keeping them Warm.** —
Deutsche Landwirtschaftliche Presse, Year XLI, No. 25, p. 315. Berlin, March 28, 1914.

Pig breeders often suffer losses through the sucking pigs being crushed under their mothers. As a means of preventing such accidents a special compartment is sometimes set apart for the sucking pigs; recently Herr Lüdemann has taken out a patent (No. 271 340) in Germany for warming this compartment and thus inducing the young pigs to stay there permanently.

The accompanying figs., 1 and 2, show the new sty in plan and section. It is about 6 ft. 6 in. × 10 ft. and provided as usual with a feeding-trough at one end. At the other end a pit about 10 inches deep and 20 wide runs all along the side of the sty; it is covered by a double sheet-iron cover, with an air-space between the two sheets, laid flush with the floor. This box cover can be heated either by a few petroleum lamps placed under it or by steam or electricity; b^1 and b^2 (fig. 2) are openings for the admission of air and for the escape of the products of combustion. At about 14 inches above the warm surface a plank, f , is fixed horizontally to the wall. Besides this a rail of wood about 6 in. square is laid on the floor and fixed at 20 to 28 inches from the pit and parallel to it.

BUILDING
CONSTRUCTION

The sucking pigs, as experience has proved, seek the warmest place in the sty, that is the sheet-iron cover (on which soft straw is laid), while

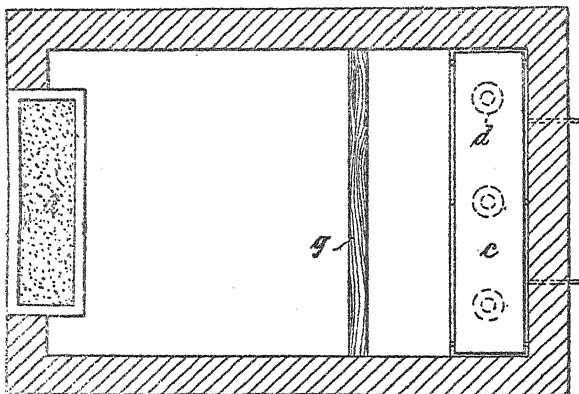


Fig. 1. — Sty for brood sow. — Plan.

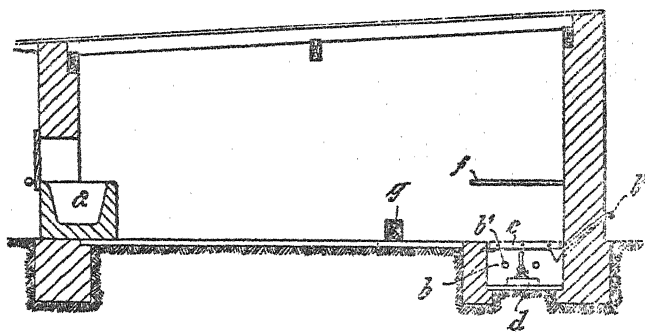


Fig. 2. — Sty for brood sow. — Longitudinal section.

the mother is kept off it by the plank, and lies down with her back against the rail *g* to suckle her offspring, which are thus absolutely safe from the danger of being crushed.

RURAL ECONOMICS.

943 — **Book-keeping Statistics on the Profitableness of Bee-keeping in Switzerland in 1912-13** (1). — Report of the Swiss Peasants' Secretariat, in *Schweizerische Bienen-Zeitung*, No. 8. Aarau, August 1914.

This Report contains the results obtained by 28 bee-keepers entered on the books of the control section of the Association of Swiss Bee-keepers

(1) For the results of the 1912 enquiry included in the preceding Report of the Swiss Peasants' Secretariat, see No. 170, B. Feb. 1914. (Ed.).

for the year 1912, and by 25 entered for 1913. These have kept regular accounts of their apiaries according to the uniform method adopted by the above section, and have placed them at the disposal of the Association, which in its turn handed them over to the Swiss Peasants' Secretariat to check and work up statistically.

In order to illustrate the method that has been followed The Table on pp. 1356-1357 gives the principal figures of these statistics.

The economic results of these 25 bee-farms cannot be generalized; nevertheless they confirm the well-known fact that both 1912 and 1913 were bad bee years in Switzerland. From the experience gained by the Swiss Peasants' Secretariat in the matter of statistics of farm book-keeping, it appears that the accounts of 100 bee farms would be sufficient to draw conclusions for the whole country.

Carefully made statistics of the accounts of bee-keepers in Switzerland are useful not only to each bee-keeper who keeps regular accounts, but also to the collectivity of bee-keepers. Consequently the Association of Swiss Bee-keepers solicits the cooperation of a greater number of contributors to this statistical enquiry, with the object of being enabled to draw general conclusions; for this purpose it supplies at a moderate price the forms for bee-keeping accounts

AGRICULTURAL INDUSTRIES.

944 - **Wine Making without Refrigeration in Warm Countries.** — GAUVRY, E., in *Bulletin de la Direction Generale de l'Agriculture*, Year 18, No. 78, pp. 389-409. Tunis, June 1914.

INDUSTRIES
DEPENDENT
ON PLANT
PRODUCTS

Refrigeration is generally considered as the final solution of the difficulties of making wine properly in warm countries. Even if not properly applied it produces finer wines, richer in bouquet. But refrigeration, either curative or preventive, requires expensive and extensive plant when, the amount of vintage to be converted into wine daily becomes considerable, and though, notwithstanding its high cost, it is still the best means of ensuring a perfect vinification even during the most violent sirocco, it is frequently difficult or impossible to use on account of the insufficient quantity and sometimes total lack of water at vintage time.

It thus became necessary to discover palliatives in order to obtain sound products with good keeping qualities in spite of the unfavourable conditions obtaining during the time of wine making. In Algeria this has been attained by the systematic use of sulphurous anhydride in heavy doses, either at the moment the vintage is placed in the vats or during the course of fermentation. But in Tunis the conditions of fermentation are still more unfavourable than in Algeria, so that the writer considers it necessary to know exactly how sulphurous anhydride behaves towards the component parts of must and what are its chemical and biological effects, in order to get the maximum benefit from its judicious use.

*Bee-keeping Statistics on the Profitableness of Bee-keeping in Switzerland (see page 1354 .
Principal average statistical data from the 1913 enquiry compared with those of 1912.*

	Per bee farm						Per hive			Percentage	
	1912			1913			1912			1912	1913
	£	s	d	£	s	d	£	s	d		
<i>Capital.</i>											
Total of capital in plant	46	5	6	43	2	6	1	16	4.8	46.30	45.69
Total of capital in produce	52	15	3	49	18	6	2	1	4.8	52.80	52.92
Current expenses	15	3		19	0		7.2		8.5	0.75	1.02
Credits	3	3		7	0		1.9		3.1	0.15	0.37
Total capital	99	19	3	94	7	0	3	18	6.7	100.00	100.00
<i>Cash account.</i>											
<i>Receipts: Honey, hives, swarms, queens, wax, honeycombs</i>											
Glasses, boxes, etc.	18	8	10	8	15	2	14	5.8		98.50	97.52
Produce of capital in plant		1	7	4	0		0.5		1.6	0.45	2.09
		4	0		10		1.9		0.3	1.05	0.39
Total receipts	18	14	5	9	0	0	14	8.2	6	100.00	100.00
<i>Outlay: Sugar, implements, repairs, sundries</i>											
Swarms, wax, honeycombs	8	2	0	6	9	6	6	4.3	4	63.47	55.63
For the capital in plant	1	10	5	15	3		1	2.4	6.6	12.01	6.46
	3	2	5	4	8	0	2	5.3	3	24.52	37.01
Total outlay	12	14	10	11	12	9	10	0	8	100.00	100.00
<i>Supplied by hives to the household and private persons:</i>											
Honey, hives, swarms, queens, wax, honeycombs, sugar	2	8	8	1	19	0	1	8.9	1	100.00	100.00
<i>Supplied by household and private persons to hives:</i>											
For the working and capital in plant; swarms, honeycombs, etc.	11	11	10	11	1	1	5.6		4.9	100.00	100.00
<i>Control of honey.</i>											
Honey collected	lbs.			lbs.			lbs.		lbs.		
sold	313			138			12.30		5.07		
delivered to household and private persons	395			132			15.47		4.85		
delivered to household and private persons	49			39.2			1.87		1.43		

Gross returns.										
	£	s	d	£	s	d	£	s	d	
Honey	14	5	6	11	2	6	—	5	10	6
Swarms, queens, etc.	4	4	9	3	3	7	—	2	7	—
Wax and honey combs	1	3	3	—	—	10	9	5	9	—
Total gross returns	19	13	6	15	5	2	—	6	1	8
of which : sold	17	9	3	13	8	4	—	4	8	5
delivered to household	2	4	3	1	8	9	—	1	5	2
Working expenses.										
Sugar	6	4	9	4	10	9	—	4	1	1
Small implements and their amortizement	13	6	—	6	4	—	—	5	0	—
Expenses for hives "	1	0	0	—	9	2	—	—	8	7
Expenses for hive houses	18	6	—	8	5	—	—	7	2	—
Sundries	1	15	3	1	4	7	—	1	1	4
Compensation for work of beekeeper, 9 1/2d per hour	5	19	3	4	8	2	—	3	2	8
Total working expenses	16	11	3	13	17	0	—	10	2	2
5 per cent. interest on capital	5	0	9	4	14	6	—	3	5	8
Total cost of production	21	12	0	18	11	6	—	13	8	0
Net returns.										
Gross returns minus working expenses	3	2	6	—	5	9	—	4	0	6
Revenue.										
Net returns plus compensation for work	9	1	6	—	1	2	0	7	1	4
Compensation for work.										
Revenue minus 5 per cent. interest on capital	4	0	9	—	5	16	9	3	1	9
Sale price of honey per pound										
Cost of production of honey per pound	s			d			s			d
Profit (+) or Loss (—) per pound	—			10			1			2
	—			0			2			0
	—			2			—			9

per cent.
of capital
— 5.82
per hour
of work
— 0s 2.4d

per cent.
of capital
3.10
per hour
of work
1s 2.6d

per cent.
of capital
— 4 0.6

per cent.
of capital
— 4 3.5

per cent.
of capital
— 4 3.5

per cent.
of capital
— 4 3.5

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per cent.
of capital
— 4 3.5

The ferment of wine presents, according to climate and locality, varieties or strains which impart to the product obtained a special bouquet, but this differentiation is caused also by a natural selection produced by adaptation to environment, to the conditions of wine-making and to the must, the composition of which is not invariable and the elements of which are modified by outside factors.

In warm countries, where the grapes attain full maturity, they are covered by very vigorous and active ferments: these are already adapted to the manner of fermentation of the country and it is they that have to be selected in order to obtain the best results when only wines of current consumption are considered. Commercial selected ferments yield in Tunis too uncertain results to allow of their employment except as a means of increasing the regularity of fermentation. Sulphurous anhydride, even in moderate doses, ensures a sufficient purification. But the ferment of mannitic fermentation and that which causes the turning of wine resist, and they are all the more dangerous inasmuch as their development is favoured by high temperatures. Their evolution may be stopped by increasing the acidity of the medium. Without this circumstance their presence would be permanent in Tunisian wines, the musts of which are always too rich in sugars, with a relatively too low acid content. One must not hesitate to acidify by means of tartaric and citric acid; but while citric acid presents remarkable advantages its use is much restricted by present legislation. With the assistance of acidification the treatment of musts with sulphurous anhydride ensures from the very beginning a practically sufficient bacterial purification to allow fermentation to set in and to develop in the best conditions.

This is the moment in which, in warm countries, the enlightened practical wine maker must interfere to dominate the evolution of the ferments and moderate their activity, as under such conditions they always have a tendency to act too rapidly. The rise in temperature which is so injurious to them is due chiefly to this excess of activity. Ferments, though aerobic, continue to proliferate even when they are deprived of oxygen; further, their activity continues by the emission of a special diastase, zymase, which has the property of instantly transforming grape sugar into alcohol and carbon dioxide, and which does not appear except under anaerobic conditions. The use of large amounts of sulphurous acid is based on these facts, as it obliges the ferment to live from the beginning an anaerobic life in a de-oxygenized medium. On the other hand it is natural that in order to start fermentation in musts treated with sulphurous acid, a ferment in full activity, whose cells have lived in contact with air so as to ensure the maximum of diastatic activity, is necessary. For this purpose an abundant ferment is prepared and the must is leavened with it. This is but a slight complication in the usual methods of wine-making.

The especially prepared ferment seems to be very advantageous, as it is particularly suitable for multiplying and working in a sulphurized liquid; it is used in priming, being placed in the bottom of a vat before filling. The thorough mixing is then performed by a pump. In order to

have a regular action of the ferment in the whole mass, the grapes are freed from the strigs in the case of red wine. This gives finer wines and allows an economy in the capacity of vats, casks, presses, etc., as well as in the labour required for the various manipulations.

In order thus to keep fermentation under the best conditions the above considerations must be borne in mind. In Algeria the *modus operandi* followed by the majority of vine growers varies more or less in details, but is everywhere based on the suppression of refrigeration and on the systematic use of sulphurous acid. For some years past the use of sulphurous acid has been quite scientifically applied by the perfecting o. BARBET's system of wine-making. By this process an absolutely sterile must can be obtained and set to ferment with selected ferments.

Vinification may be retarded at will; in warm countries it may be deferred to the winter months, and this is not the least interesting aspect of the process for Tunis. The possibility of blending musts of different kinds also arises, allowing of the preparation of a single juice of uniform composition for the year.

With the object of obtaining a prolonged state of inactivity in the must, enormous doses of sulphur dioxide have to be employed, and in these conditions even a very active aeration cannot eliminate enough of it to allow fermentation to be set up. BARBET has also solved this difficulty by causing the must to fall through a column of plates in which it is traversed by an ascending column of air. But this method has not received the favour it deserves on account of the price of the apparatus. DEPATY's desulphurizer, which is based on the principle of aeration by warm air, being cheaper is preferred. Good quality products are thus obtained, but their cost price is still high.

At present experiments are being carried out at the Tunis Laboratory, which promise a much simpler solution of the problem, namely of causing a partial desulphurization of the must, sufficient to allow a regular fermentation by means of ferments accustomed to sulphurous acid.

945 - **Refrigeration in Wine Making.** — LABARDE, J., and DELBAVIE, J., in *L'Industrie frigorifique*, Year 12, No. 135, pp. 179-191. Paris, June 1914.

In a report on the work carried out by the Oenological Commission for the South West of the "Association Française du Froid", the results of experiments made, according to a programme of research, on the effect of cold on wines are given.

The subjects to be studied were: 1) The treatment of wines by short and rapid refrigeration according to the process usually adopted by the "Compagnie générale aérohydraulique"; 2) Slow and prolonged refrigeration in cold chambers at different temperatures: about 0° C. and —3° C. (32° F. and 26.6° F.). The following wines were experimented upon: *red wines*, Génissac, Château Nodot, Anglade du Blayais, Bas Médoc; *white wines*, La Brède, Les Salles de Castillon.

The above Company's plant for rapid refrigeration consists essentially of two parts: 1) a refrigerating system; 2) some cooled vats. On leaving the refrigerator the wine is sent into vats of the capacity of 1100 gallons, in

which it usually remains a week ; it is then racked and sent to a filter where it is clarified at a temperature which is still fairly low.

In order to estimate the effect of these treatments, the wines were tasted and submitted to chemical analysis.

Considering only the concordant results of the second and third tasting, undertaken at a time when the wines had in all likelihood assumed their state of equilibrium, refrigeration applied according to the various methods to red Gironde wines proved favourable three times out of four. Among white wines, in the La Brède wine the improvement was more marked at the second tasting than at the first ; the Castillon wine was improved by the complete treatment by rapid refrigeration, while refrigeration alone did not yield the same results.

The analytical data obtained from the wines experimented upon are collected in tables and they show that rapid cooling determines in general a slight thinning of red wines. Rapid cooling and filtering acts particularly on the flavour of the wines, improving it. Prolonged refrigeration in cold chambers has in general a more pronounced effect than the former treatment. On tasting wines subjected to it they are generally classed first of all.

The differences observed in tasting were always very slight, and were considered by the tasters, who classified the wines with the greatest care, as in general only shades.

The object aimed at by the Commission was to know if the use of artificial cold on wines could have the same effect as natural cooling. In some localities this cooling may extend over a fairly long period and with sufficient intensity, without however attaining the freezing of the wine, and according to current and very old observations the result is always favourable to the actual and future quality of the wine.

The experiments of the Bordeaux Commission, though limited to a small number of wines, prove that by artificial cooling the principal advantages attributed to natural cooling may be obtained.

The number of white and red wines studied is, no doubt, insufficient to allow of much generalization of results, and if the Commission limited itself to this number, it was because the programme of the experiments contemplated the study of multiple conditions of the application of artificial cold. It has been recognized for the moment that rapid refrigeration has not given very marked results ; on the other hand observations have been clearer as to the prolonged stay of the wine in cold chambers. In the future, investigations must be made with the object of obtaining the maximum effect of low temperature in the shortest time. There is thus a whole series of new experiments to be made and the Commission hopes to be able to continue its researches.

946 - A New Method of Making Wine and of Utilizing the Pomace. — MONTI, E., in *Giornale Vinicolo Italiano*, Year 40, No. 33, pp. 769-772. Casale Monferrato, August 16, 1914.

In view of the fact that within certain limits wine is all the richer in alcohol and perfume the slower the process of fermentation has been, and

recalling that some years ago he had prepared a partially fermented and intensely coloured must ("enocyanine krios") to be added to light wines with the object of increasing their alcohol content and colour, Sig. Monti observes that by retarding the commencement of fermentation, time is given to the must to dissolve the colouring matter, the acids, the albuminoids and the other substances contained in the pulp adhering to the pips.

This observation, together with the consideration that the only means of obtaining a harmless sterilization is moderate heat, and that in must the disadvantageous separation of albuminoid and phosphatic matter does not take place under 60° C. (140° F.), suggested to the writer a new method of wine making which the director of the *Giornale vinicolo* (E. Ot-tavi) considers a real and important discovery.

The writer proposes to exhaust the fresh pomace systematically by diluted must heated to 55-60° C. (131-140° F.), thus ensuring the complete separation of the sugar, colouring matter, acids and other useful substances contained in it. The result of the operation is a liquid possessing a density equal, or only slightly inferior, to that of the must obtained by the first pressure, and of an intense colour. On cooling, all the argol contained in the pomace separates completely and on concentrating the liquid by continuous freezing, or *in vacuo* in an apparatus heated by warm water, a juice is obtained containing from 60 to 75 per cent. of sugar. It is so intensely coloured as to require from 10 to 30 volumes of water, according to the quality of the grapes used, to bring it down to the intensity of colour of common wine. This product, which the writer calls "Estratto integrale d'uva" (whole grape extract) keeps absolutely unchanged for years. It may thus be prepared in large quantities in years of plenty and used to improve the wines produced in years of bad or insufficient vintage.

This extract may be prepared from common black grapes or from fine or white varieties, of which it retains the perfume; it is very useful for improving wines poor in tannin or solids. The addition of this extract to the must increases the quantity of wine by 10 or 15 per cent., and to a slight extent its alcoholicity, besides imparting to it a more delicate flavour and perfume. The preparation of this extract allows a fuller utilization of the pomace.

947 - Determination of the Tartaric Acid in Wines by Physico-Chemical Volumetric Analysis. — DUBOUX, MARCEL, in *Annales de Chimie Analytique*, Year 19, No. 3, pp. 89-97. Paris, March 15, 1914.

The processes for determining the total tartaric acid in wines under the form of potassium bitartrate present the following great drawback: the deposition of the crystalline precipitate requires from one to three days and the results are not independent of the method followed. The writer has thus endeavoured to effect this determination by the method of electric conductivity or physico-chemical volumetric analysis, which allows the rapid and precise determination of the following elements of wine: ash, potash, lime, magnesia, sulphates, chlorides, phosphates, ammonia, acidity, alkalinity, etc. The physico-chemical method presents in all cases a marked advantage over volumetric or gravimetric methods, and this has

induced several chemists to adopt it in connection with the usual analytical methods (1).

The study of the determination of tartaric acid in wine by means of conductivity shows that this method is of interest to the chemist who already analyses wines by physico-chemical volumetry. Knowing the acidity of a wine and its exact content in sulphates, he can by a simple titration which takes only 10 to 15 minutes, determine the total tartaric acid in the wine with a precision equal if not superior to that obtained by the usual methods. These results are always rigorously exact in the case of wines of low acidity. They are somewhat less exact when the wines contain an abnormally high quantity of malic acid. If the wine under examination had been treated with citric acid this would be counted as tartaric acid. It would then be advisable to determine the tartaric acid by the bitartrate method and the citric acid by difference.

The writer describes the technique of the operations and the reagents employed for precipitation (nitrates of lead, silver, lanthanum and uranyl, barium chloride and acetate, caustic baryta). He gives two precipitation curves and the results of the determination of tartaric acid by physico-chemical volumetric analysis in a white wine and in a red one. He then compares in a table the results obtained: 1) by the German official method; 2) by the French official method; 3) by the conductivity method. These figures show that: 1) for wines containing not much acidity, the three methods yield results which agree well with each other; 2) with very acid wines the agreement is not so complete; 3) the official French process yields too low values when the wine contains large quantities of sulphates.

INDUSTRIES
DEPENDENT
ON ANIMAL
PRODUCTS

948 - Ratio between the Specific Gravity of Cow's Milk and its Percentage Content of Fat and Dry Matter. — FLEISCHMANN, W., in *Journal für Landwirtschaft*, Vol. 62, Part 2, pp. 159-172. Berlin, 1914.

The writer compares the best known formulae for calculating one of the three quantities (specific gravity, fat content and dry matter) from the other two and concludes that all the formulae, even the relatively most precise, are only approximative and can only by chance in some cases yield results which agree with those obtained by analysis.

Considering, however, the uncertainty of determining analytically the weight of the dry matter in milk, it is preferable to determine it by calculation rather than by direct determination, provided formulae which give the nearest possible approximation be used, and the greatest care be taken in determining fat content and specific gravity.

The formula recommended is the following:

$$t = \frac{4.8 \times f \times d}{4} + 0.25$$

in which t = dry matter

f = fat content

d = degrees of lacto-densimeter.

(1) See article by PAUL DUTOIT and MARCEL DUBOIX: "Analysis of Wines by a Physico-chemical Volumetric Method." — *B. Dec.* 1912, pp. 2562-2569. (Ed.).

The results obtained by this formula agree very nearly with those yielded by Fleischmann's well-known formula.

949 - **An Investigation into the Composition of Cheese made from Whole Milk.** — BROWNLEE, G., in *Department of Agriculture and Technical Instruction for Ireland, Journal*, Vol. XIV, No. 3, pp. 499-506. Dublin, April 1914.

Cheese, properly so-called, ought to be made from whole milk, and should contain as nearly as possible all the fat in the milk from which it was made. Hitherto it has not been easy to condemn cheeses made from skimmed or half-skimmed milk, as there is no standard defining what percentage of fat a whole-milk cheese should contain. To obtain comparable figures suitable for the fixing of a minimum fat content, it is necessary to eliminate the factor water, which varies considerably, even sometimes in cheeses of the same type.

In order to determine what would be a reasonable figure for this standard, the Department of Agriculture and Technical Instruction for Ireland arranged for analyses of Caerphilly and Cheddar cheeses, representing semi-hard and hard cheeses respectively, to be carried out from October 1911 to June 1913 by the Albert Agricultural College, Glasnevin, and the Royal College of Science, Dublin. In each case the test was made with: 1) a sample of the whole milk before manufacture; 2) a sample of the "green" cheese, and 3) a sample of the "cured" cheese.

The results showed that the percentage of fat in the dry matter never fell below 47. In the case of Cheddar cheeses the maximum and minimum were respectively 53.54 and 48.72 in the green, and 52.96 and 48.60 in the cured. In the case of Caerphilly cheeses the corresponding figures were respectively 56.99 and 47.75 for the green and 57.15 and 47.11 for the cured cheese. The average percentage of fat in the dry matter of all the green cheeses is 51.49, and of the cured cheeses 51.19. The general average for all samples (327) is 51.33. Thus 45 per cent. can be fixed as the limit below which the percentage of fat in the dry matter of a genuine cheese should not fall.

Incidentally, the collected results also show that 1 gallon of milk will yield:

- 1.300 lb. of green Caerphilly cheese.
- 1.239 lb. of cured Caerphilly cheese.
- 1.056 lb. of green Cheddar cheese.
- 1.000 lb. of cured Cheddar cheese.

950 - **On the Characteristic Flavour of Roquefort Cheese.** — CURRIE, J. N. (Chemist, Dairy Division, Bureau of Animal Industry, U. S. Department of Agriculture) in *Journal of Agricultural Research*, Vol. II, No. 1, pp. 1-14. Washington, April 1914.

These researches were initiated to identify the substances which impart the characteristic Roquefort flavour and to account for their presence. After giving a résumé of the preceding work on this subject, the writer describes his experiments as follows:

- 1) The experimental method adopted was that employed by JENSEN.
- 2) *Volatile acids.* — The soluble acids present were essentially a mixture of the volatile fatty acids of milk, *viz.* acetic, butyric, capric, caprylic, caproic. The insoluble constituent contained chiefly capric acid. They may be pre-

sent as free acid or in a feeble state of combination without losing their characteristic flavours. A ripe Roquefort cheese gives a distillation number (*i. e.* the number of cc. of decinormal alkaline solution necessary to neutralise 100 cc. of the distillate) between 30 and 60, whilst a slow-ripening cheese of poor flavour gives a distillation index less than 30, and a quick-maturing cheese of highly developed flavour will have an index above 60, in some extreme cases even exceeding 100.

3) *Relation between volatile acids and flavour.* — The writer is of opinion that the cheese owes its piquant flavour to the accumulation of volatile acids (caproic, caprylic and capric) and their easily hydrolysable salts. These generally occur free, or in such feeble combination that their flavour is not masked.

4) *Origin of the volatile acids.* — Since these acids comprise those found in the fatty matter of milk, from lauric to butyric, and in almost the same proportions, the writer believes these acids are derived from the hydrolysis of the fatty matter of the cheese. The small quantities of acetic and possibly formic acid can be accounted for by the fermentation of carbohydrates in the early period of maturation or by the partial oxidation of higher acids or of glycerine during the ripening period.

5) *Culture experiments with *Penicillium Roqueforti*.* — Cultures were made in Czapek's solution and by inoculation of sterilized coagulum. In the former case about two-thirds and in the latter about one-half of the fatty matter was hydrolysed without an appreciable accumulation of soluble and volatile acids. In the natural cheese, however, these products accumulate, probably on account of the limited supply of oxygen preventing the complete oxidation of the butyric and caproic acids, or more probably because during maturation, especially in the interior part of the cheese where ripening is more complete, soluble enzymes such as lipase are present.

6) *Enzymes.* — A lipase was extracted from the mycelium of *Penicillium Roqueforti*. It was also shown that the ripening process is promoted by an enzyme capable of hydrolysing simple esters as well as glycerides.

The writer concludes that :

1. During the ripening of Roquefort cheese a considerable quantity of fatty matter is hydrolysed.

2. *Penicillium Roqueforti* produces a lipase soluble in water, which is responsible for the hydrolysis.

3. The hydrolysis causes an accumulation of free or combined fatty acids.

4. The piquant flavour of Roquefort cheese is due to caproic, caprylic and capric acids and their easily hydrolysable salts.

A bibliography of 16 works is appended.

PLANT DISEASES

DISEASES NOT DUE TO PARASITES AND OF UNKNOWN ORIGIN.

951 - **Withering of the Panicle in Rice.** — POLI, POLO, in *Il Giornale di Riscoltura*, Year IV, No. 14, pp. 206-209, 2 figs. Vercelli, July 30 1914.

The phenomenon described as "colatura" consists in a special abortion of the flowers of the apical spikelets of the panicle, which become reduced to whitish filaments more or less shrivelled and twisted, forming a small tuft which disappears before the grain is ripe. This results in a diminution of the yield.

Certain varieties of rice, in particular Italian varieties and those grown for a long time in Italy and thus more susceptible, are more frequently attacked by this disease than the hardier and more resitant Japanese varieties. Thus, for example, the varieties Ostiglia, Ranghini, Nero di Vialone, and Greppi are conspicuously attacked, whilst Originario is less so.

This disease must not be confused with a very similar phenomenon produced by hail at certain times and in certain conditons of the growth of the plant, namely, when the stem is already swollen and the panicle on the point of appearing from its sheath. Then, if a large hailstone strikes the leaf near the base, it bends back and breaks, thus forming an obstacle to the opening of the sheath, and preventing the regular development of the panicle. This forces a lateral opening and remains caught with the apical grains in the sheath, unable to grow up straight and thereby becoming sterile.

As the result of researches carried out in different seasons, the writer considers the disease is generally due to the coexistence of two principal causes, namely, excessive fertility, and a period of intense cold at the time corresponding to the last phase in the formation of the flowers, when the panicle is still enclosed within the sheath.

BACTERIAL AND FUNGOID DISEASES.

BACTERIA

- 952 - The Status of Investigational Work on Pear and Apple Blight. — SWINGLE, DEANE B., in *Montana Agricultural College Experiment Station, Circular* 39, pp. 13-16. Bozeman, Montana, 1914.

Pear and apple blight is a serious disease which has been observed in the United States (Hudson River Valley) since 1792. J. T. Burrill in 1878 discovered the cause of the disease to be a bacterium called *Bacillus amylovorus*. In 1889 M. B. Waite, of the U. S. Department of Agriculture, observed that some insects convey the bacterium from the partially dead bark bordering on that which is still healthy to the flowers when these begin to open in spring, and thus assist greatly in spreading the disease. Of late years the disease has been studied by several American Experiment Stations from all points of view, as well as the different susceptibility to it of the different kinds of pears and apples, the influence of climate and soil on its virulence and the effects of the most varied fungicides and insecticides. These researches are being actively continued. The Circular invites practical farmers to have faith in the experimental investigations of phytopathologists and not to allow themselves to be taken in by the vendors of specific remedies consisting of chemicals to be spread on the soil or injected into the trunks of the trees, as the efficacy of such remedies has not been borne out by any rigorously conducted scientific experiment.

FUNGI

- 953 - Observations on the Life-History of the American Gooseberry-Mildew (*Sphaerotheca Mors-Uvae*). — SALMON, E. S., in *The Annals of Applied Biology*, Vol. I, No. 2, pp. 177-182. Cambridge, 1914.

Sphaerotheca mors-uvae (Schwein.) Berk et Curt. differs from other introduced Erysiphaceae in producing abundance of perithecia under normal conditions in Europ.. Many of these remain in the patches of mycelium on the shoots until the following spring. According to English legislation fruit growers who do not remove these shoots during the winter are liable to prosecution. The writer suggests the possibility that only perithecia formed during the summer attain maturity; such perithecia germinate easily in contact with a drop of water. On reaching maturity they usually fall to the ground; the perithecia formed later do not hibernate, but always perish, as well as the patches of mycelium, and consequently cannot become sources of infection. It may therefore be necessary to modify the Regulations on compulsory control. It remains now to ascertain how the spring infection takes place. It does not appear that it is always due to the ascospores coming from the ground, because in some cases observed by the writer the first berries infected were the highest; probably many mature perithecia in falling, especially during autumn pruning, get caught in the crevices of the bark or between the bud-scales and there germinate in spring.

954 - **Burgundy Mixture.** — FONZES-DIACON, in *Le Progrès agricole et viticole* (Edition de l'Est-Centre), Year 35, No. 29, pp. 70-80. Montpellier, 1914.

In this communication presented to the International Congress of Viticulture at Lyons in July 1914, the writer gives an account of his laboratory researches on the composition of neutral, acid and alkaline Burgundy mixture. The superiority of acid sprays (*i.e.* all mixtures containing an excess of copper sulphate), as confirmed by the writer, appears to be due not only to the excess of free copper which they contain, but also to the presence, in solution as well as in the precipitate, of the basic sulphate ($\text{Cu SO}_4 \cdot 3 \text{CuO}$, $4 \text{H}_2 \text{O}$) which is insoluble in pure water but very soluble in presence of dissolved carbon dioxide.

It is also to the presence of this basic sulphate that the mixture owes its property of keeping.

Wetting Burgundy mixtures should belong to the acid type, since alkaline mixtures (*i. e.* those containing an excess of free sodium carbonate) enclose only a little or none at all, of this basic sulphate in their precipitate, and have none in solution.

In the preparation of these acid sprays, the dilute solution of sodium carbonate should be slowly added to the concentrated copper sulphate solution which is stirred constantly.

To obtain an acid spray containing about 200 to 500 gms. of free copper sulphate per hectolitre, about 350 to 500 gms. of 90 per cent. sodium carbonate should be added for each kilo of copper sulphate. The copper sulphate is dissolved in 10 to 15 litres of water and the sodium carbonate in the remaining 85 or 90 l.

955 - **A New *Botrytis* on Flowers of Red Clover in Russia.** — BONDARTSEFF, A. S., in *Xurnal Bolesni Rastenii* (Journal of Plant Diseases), Year VIII, No. 1, pp. 1-25, figs. 1-3, plates I-IV (abstract in German). Petrograd, 1914.

The writer has found the flowers of red clover (*Trifolium pratense*) in Russia attacked by a new species of *Botrytis*, which he describes as *B. anthophila*.

The mycelium of the parasite penetrates into all parts of the plant, but is most prominent in the intercellular spaces; it develops its conidia on the anthers. The disease is spread by means of the seed and the writer has observed the mycelium below the seed coat of seeds produced from artificially infected flowers, as well as in those of naturally diseased plants. The presence of the fungus appears to have no effect on the cut of clover. The damage only concerns the anthers and consists in a loss of germinative power of the pollen grains, which appear very deformed under the microscope.

The writer points out that the diseased plants produce a smaller quantity of seed than healthy plants, but the germinating capacity of the seeds produced is higher, being about 63 per cent., whilst that of seeds from healthy plants does not exceed 43 per cent.

In every case the seeds harvested from diseased plants are smaller, shrivelled and less heavy than normal seeds.

The writer considers that seed-testing stations should carry their investi-

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gations to the testing of the degree of infection of clover seeds with this fungus, as is already done in the case of cereals infected by smut, *Fusarium*, etc.

In 1913, *B. anthophila* was found in the following provinces: Petrograd, Tula, Kursk, Voronezh, Pskov, Novgorod and Ufa. This would lead one to suppose that the fungus is widely spread and that in case of a bad crop of clover seed the damage is often attributable to this disease alone.

The diseased flowers can sometimes be recognized by their dirty pale violet colour, though flowers with this appearance are not necessarily infected. The disease can easily be recognized by opening the flowers and removing the anthers, which when normal are yellow in colour but when attacked by the disease the conidia of the parasite give them a grey dusty appearance.

956 - **Potato Diseases in Great Britain.** — HORNE, A. S., in *The Annals of Applied Biology*, Vol. 1, No. 2, pp. 183-203, figs 1-8. Cambridge, 1914.

This paper is a critical review of the principal potato diseases which are at present of importance in Great Britain and also of the steps that should be taken to know them better and to control them efficiently. Some of these diseases are treated at length: wart disease or tumour (*Synchytrium endobioticum*), potato disease, late blight or murrain (*Phytophthora infestans*); "sprain", a disease of the tubers, the origin of which is still obscure, and which includes two forms: "blotch" (internal disease) and "streak" (sprain); *Fusarium* disease, under which two types of disease are recognized: *Fusarium* wilt caused by *F. oxysporium*, one of the most serious diseases of the potato in the United States, which does not seem to have appeared in Europe, and the dry-rot disease which appears to be caused by one or more species of *Fusarium* including *F. Solani*, of rare occurrence in Great Britain; leaf-curl (German "Blattrollkrankheit"), according to the writer not due to parasites; and lastly canker or powdery scab (*Spongospora Solani*).

957 - **Celery Leaf-Spot Disease (*Septoria Petroselinii* var. *Apii*) in England** (1). — CHITTENDEN, F. J., in *The Annals of Applied Biology*, Vol. 1, No. 2, pp. 204-206. Cambridge, 1914.

The seed of celery (*Apium graveolens*) is the chief, if not the only, carrier of the disease caused by *Septoria Petroselinii* Desm. var. *Apii* Br. et Cav. The seedlings as soon as they emerge from the ground already carry the fruits of the fungus on the cotyledons and on the plumule; the disease then remains localized on each plant and does not pass from one to another.

Samples of "seed" — the commercial term for the whole or halved fruits (mericarps) of celery, mixed with other parts of the plant — which were examined by the writer were found to contain 90 per cent. of infected seeds; consequently it will be advisable to see to the disinfection of the seed and to its collection only from healthy plants.

(1) See also No. 3242, B. Nov.-Dec. 1911.

(Ed.).

958 - **Black Rot of Grapes (*Guignardia Bidwellii*) in Spain.** — RAVAZ, L., in *Le Progrès agricole et viticole*, Year 31, No. 30, pp. 114-115. Montpellier, 1914.

France was formerly the only country in Europe in which the black-rot fungus (*Guignardia Bidwellii* Viala et Ravaz) was known; this fungus has now been reported in Spain. It has not of late years caused as much damage as formerly, probably owing to the absence of the sclerotial stage. Vine leaves and grapes showing the distinctive characters of the disease have been received from the province of Valencia. The fruits were almost entirely destroyed by the disease, thus showing the serious importance of the outbreak.

959 - **A Contribution to our Knowledge of Apple Scab.** — MORRIS, H. E., in *Montana Agricultural College Experiment Station, Bulletin*, No. 96, pp. 69-102, 1 plate + 3 figs. Bozeman, Montana, 1914.

In the State of Montana, apple scab (*Venturia inaequalis*, conidial form *Fusicladium dendriticum*), so common a disease in all portions of the civilized world where the apple is grown, appeared first on the east side of Flathead Lake about 1900 and spread slowly all round.

During the summers of the last three years climatic conditions were favourable for the development of apple scab and the occurrence of twig infection was not at all infrequent, especially on the McIntosh variety. On the shoots the spots caused by the disease are similar to those occurring upon the fruits, except that they are minute, being scarcely visible to the naked eye though readily seen under a low magnification. Living cultures were obtained from some of these spots during the month of March, but no data were secured as to the extent to which such twigs are a source of spring infection.

The primary spring infection period in the State of Montana corresponds to that observed by Wallace, according to whom the spring infection occurs about the time the ascospores mature, if weather conditions at that time are favourable; but during the cool damp seasons of 1911 and 1912 late summer or secondary infection occurred. This took place about the middle of August or beginning of September and at harvest time many minute scab spots were visible on the fruit, which might have been prevented by late spraying.

The observations of the writer, covering a period of several years, confirm the opinion of Wallace that *V. inaequalis* is a species entirely distinct from *V. pirina* (pear scab). He has seen scab abundant on apple trees while Flemish pear trees in the same orchard were not attacked; yet Flemish pear is generally conceded to be very susceptible to scab. In older sections, where both diseases have been prevalent for years, this fact could not be observed.

The injury and corresponding loss to the apple crop due to the presence of scab is far greater than is generally believed; nevertheless it is difficult to value in money the total loss due to the disease. A conservative estimate of the loss due to scab in the Bitter Root Valley during 1911 and 1912 would be 15 per cent. of the entire crop. This loss is due to the reduction in price or to total destruction of the fruit by the fungus.

As there are early blooming varieties of apples and late blooming ones, their proper distribution is important in the control of the disease. When the varieties are badly mixed in rows it is commercially impracticable to spray at the proper time; the difference in time between the blooming of the different varieties necessitates extra sprayings. For this reason it is desirable to set the trees in separate blocks. For equally susceptible varieties which blossom about the same time this would not be so important, but it is never advisable to mix susceptible and resistant varieties. It is well known that there are great differences among the varieties of apples grown in Montana with respect to their susceptibility to scab. The selection and improvement of scab-resistant varieties may be one of the effective methods of dealing with the problem. No variety of apple is immune from scab under the most favourable conditions for the development of the fungus, and it is also recognized that varietal susceptibility may vary in different localities. The opinion of several authors that certain varieties may be resistant in one year and susceptible in another year under conditions which for average varieties are as favourable to the disease in one case as in the other, apparently does not apply to Montana. The writer gives a table in which the 44 varieties of apples commonly grown in the western part of the State are divided into 4 classes (practically resistant, moderately resistant, moderately susceptible, susceptible). It is the result of observations covering a period of five years, three of which were favourable for the development of the apple scab fungus.

The practically resistant varieties are: Hubbardston, Oldenburg (Duchess), Wagener, Wealthy, and York Imperial.

The two fungicides which have been used to a considerable extent in the State are lime-sulphur and Bordeaux mixture; lime-sulphur is the more important and is used generally at a strength which approximates that recommended by Scott (4 lbs. of sulphur in solution to 50 gallons of diluted spray). Bordeaux mixture, owing to the russetting of the fruit and burning of the foliage, has been almost entirely replaced by lime-sulphur.

For controlling scab on susceptible varieties — classes 3 and 4 — five applications should be given at specified times; for the fairly resistant varieties — classes 1 and 2 — two sprayings should be given, namely one when the flower buds show a pink colour and the other when most of the petals have fallen; according to weather conditions one later spraying may sometimes be advisable.

According to experiments carried out in Montana on 1200 six-year-old trees, the cost of spraying once with lime-sulphur is 2 cents (1¢) per tree.

The writer has cultivated the conidial form (*Fusicladium dendriticum*) of *V. inaequalis* in several artificial media with varying success.

The paper concludes with a bibliography referring to 505 works on the subject.

- 960 - **Rotting of Pomegranates in India: *Sterigmatocystis castanea*.** — BUTLER, E. J., in *The Agricultural Journal of India*, Vol. IX, Part II, pp. 205-206. Calcutta-London, 1914.

Specimens of pomegranates were recently received from a garden in Bombay, which, though of excellent external appearance, were blackened and rotting inside. The rot was found to be due to a fungus, *Sterigmatocystis castanea* Patterson, and the disease to be identical with one described in 1912 as a new and serious disease of this fruit in America, where it had been first observed in the United States in 1910.

In the more advanced stages of the disease there are cavities inside the fruit filled with a brown powdery substance, composed of the spores of the fungus.

It is suggested in the United States that the fungus gains an entry while the calyx is open; subsequently the calyx closes and the parasite develops within the growing fruit. If this be the case it is hard to see how the disease can be checked. But there is another possibility: several cases are known where fruit which is externally sound is mouldy inside, and in these cases the mould is frequently some common species, whose spores are likely to be present in the air in considerable quantity. Walnuts are, perhaps, the most familiar example of this condition. Tea seed is also not infrequently affected in a similar manner, and very probably the mould gains an entry through punctures in the young fruit caused by a large sucking insect. It is possible that the pomegranate rot is due to a similar cause, and if so, the question of its prevention resolves itself into the question of preserving the young fruit from such insect attacks. The writer proposes, with the co-operation of fruit growers, to ascertain whether this hypothesis has any foundation in fact.

- 961 - **The Bud-Rot (*Pythium palmivorum*) of Coconut Palms in Malabar (1).** — SHAW, F. J. F., and SUNDERARAMAN, S., in *The Agricultural Journal of India*, Vol. IX, Part II, pp. 111-117, plates IX-XI. Calcutta-London, 1914.

In October 1912 the first report of a serious disease of coconuts in Malabar began to attract attention. The first outbreak noticed was at Tamarasserri; for several miles round this village, cases of the death of single coconut trees in different gardens were common. In February 1913 the neighbouring localities of Kidavur, Pallipuram, Karothur, Vavada, Poonur, and Puthupadi were inspected and a number of adult plants and in some cases also young seedlings which had been transplanted only a year before, were found to be more or less diseased. Enquiries made in the locality seemed to show that the disease was of about ten years' standing, but it has spread so slowly that it had not alarmed the growers.

The true cause of the disease was not identified when the first inspection was made, the weather at the time being hot and dry, and it was decided to make further investigations during the rainy season.

For this purpose, Tamarasserri was visited about the end of July at the height of the monsoon, when the nature of the disease at once became

(1) See also B. Dec. 1910, pp. 368-370.

(Ed.).

apparent from a study of young trees in an early stage of infection. The first symptom by which a diseased tree may be recognized is that the central leaf turns brown, collapses and dies. As everyone knows, the youngest central leaf of a coconut is folded up like a fan. If now the dead central leaf be removed and unfolded, it will be found that at the point where the leaf has collapsed the folded lamina is covered with a white fluffy growth of fungus. This fungus, starting at one point of the leaf, eats its way straight through the folds of the lamina and produces a softening of the tissues leading to the collapse of the leaf at this point ; as a result of this the portion of the leaf above the point of infection turns brown and dies. In cases in which the infection is very recent and the whole leaf has not had time to turn brown, the area infected by the fungus gives rise to very characteristic rows of spots. If, as sometimes happens, the attack does not spread beyond this point, then when the central leaf expands, a row of brown spots in which the leaf tissue has decayed away can be seen stretching across the leaf.

In material from recently infected leaves it was possible to make a very complete examination of the morphology of the fungus, which left no doubt that it was to be identified with *Pythium palmivorum* Butl., the cause of the bud-rot of palmyras (*Borassus flabellifer*).

On leaf spots, the white fluffy mycelium of the fungus bears abundant sporangia, which under appropriate conditions of moisture discharge their spores. In the case, therefore, of a tree in which the central leaf is attacked it is easy to see how the infection spreads. A single day's rain would be sufficient to wash the spores down from the central leaf into the interstices of the bases of the older leaves, where the fungus would find the most favourable conditions for development. In this way, and sometimes doubtless by infection from other trees, the fungus forms rotten spots on the leaf bases, which vary in size ; they are of a dark brown colour and present a fibrous appearance.

Once the fungus has become established in spots on the leaf bases, the death of the palm is a mere matter of time. The mycelium eats its way in, passing from one leaf-base to another, and finally reaches the growing point and kills the tree. As this goes on, the outer leaves gradually droop and fall off, while the spread of the rot is accelerated by various saprophytic fungi, bacteria and insects. In the final stage of the disease the tree is left as a bare pole with, possibly, a single discoloured leaf drooping from the crown. In the later stages of the disease when the outer leaves are falling, it is not easy to identify the fungus; the apex of the palm is then a semi-liquid putrescent mass in which saprophytic organisms are extremely abundant. In the early stages of an infection it might be possible to confuse a case of tree bud-rot with an attack by Rhinoceros beetle (*Oryctes rhinoceros*). However, in those cases of bud-rot in which the infection is recent and the whole of the central shoot is not involved, the rows of spots on the folded lamina constitute a reliable criterion of distinction.

From a consideration of the habit of *P. palmivorum* it is not difficult to see how such a disease would spread once it was established in any one locality. On a windy wet day drops of water containing spores may easily be blown from one tree to another, while the practice of climbing trees for leaf cutting and tapping for toddy would also favour the dissemination of the fungus.

The writers obtained the parasite in pure cultures and were successful in carrying out new infections with them.

At the same time at which this disease was diagnosed at Tamarasserri and neighbouring localities, it was also identified in other parts of Malabar (Malappuram, Melmuri, Calicut, Kurmathur, Andoor, Koyyam, etc.).

At present the disease appears to be scattered throughout Malabar, but fortunately nowhere with the virulence seen in palmyra palms in certain localities of the Godavari district.

In both the palmyra and coconut palms it is difficult to recognize the symptoms of disease in an early stage. This fact, coupled with the difficulty in applying any treatment to palm trees, renders the destruction of infected trees the surest method of controlling the disease. As has been done in the Godavari district, the local authorities are taking active steps for the destruction of the affected trees in the various districts of Malabar, where, more fortunately than in Godavari, it has been possible to diagnose the disease in its initial stage. Since the beginning of operations 352 diseased trees have been identified and of these 150 have already been destroyed.

Among the factors influencing the spread of the disease, that most favourable to the growth of the fungus is the degree of moisture.

962 - **Wood-destroying Fungi which Grow on Both Coniferous and Deciduous Trees in the United States of America and in Europe.** — WEIR, JAMES R., in *Phytopathology*, Vol. 4, No. 4, pp. 271-276. Baltimore, Md., 1914.

In the course of investigations on the fungi attacking forest trees in the North-West States, the writer found many new and exceptional hosts for certain fungus species heretofore supposed to be strictly confined to coniferous or deciduous trees. In connection with the facts discovered, there is one which must not be overlooked in the correct determination of similar species growing under a great range of conditions, namely the great variation induced in some characters of their sporophores.

The following is a first list of fungi and their new or exceptional hosts.

Hydnum coralloides Scop. (?), abundant on the wood of deciduous trees, especially on *Populus*, has been found in the forests of Idaho and Washington on *Abies grandis* and occasionally on *Picea Engelmanni*.

Stereum hirsutum Willd., frequent in the West on various hardwoods, has been found occasionally on conifers, usually on branches of *Abies grandis* and *Tsuga heterophylla*.

S. purpureum Pers., which usually grows on *Populus*, *Salix* and *Betula*, has been collected on moist branches of *Larix occidentalis*.

Hymenochaete tabacina Sid. is common on both conifers and broad-leaved trees in the North-West.

Trametes Pini (Brot.) Fr., apparently never reported as growing on deciduous wood, has been collected on *Betula occidentalis* in Idaho.

T. picienus Pk. on *Crataegus* sp. in the West.

T. suaveolens L., common throughout the West on *Populus* and *Salix*, has been found on *Abies grandis*.

Polyporus giganteus (Pers.), described by Murrill as growing on deciduous trees, has been found on conifers in Idaho, more often in connection with old decayed roots of Douglas fir, and on *Pinus sylvestris*.

P. frondosus Fr., known on the roots of Italian chestnuts, and *P. umbellatus* (Pers.), have been frequently observed on conifers in Idaho and Washington.

P. Berkeleyi Fr., found in the East at the base of oaks, has been collected on *Larix occidentalis* in Idaho.

P. picipes Fr., common on *Populus* in Idaho and Washington, has been collected on *Picea Engelmanni* and *Abies grandis*.

P. chioneus Fr., usually found on wood of deciduous trees, is quite common on conifers in the North-West, principally on *Thuja plicata*; it has also been found on *Pinus monticola* and *Tsuga heterophylla*.

P. adustus Fr., common on *Betula occidentalis* and on species of *Populus*, is occasionally found on *Larix occidentalis*, *Thuja plicata* and *Pseudotsuga taxifolia*, though very rarely.

P. dichrous Fr., associated in the East with *Quercus alba*, is common on *Juniperus virginiana* in the vicinity of Washington, D. C., and has recently been found to be a serious sapwood fungus on various North-Western conifers (*Thuja plicata*, *Tsuga heterophylla*, *Pinus monticola* and *Larix occidentalis*).

P. sulphureus Fr., common in Europe on both coniferous and broad-leaved trees, attacks practically every native forest tree in America.

P. caesius Fr., which ordinarily occurs in the East on the wood of deciduous trees, is common in Idaho and Washington on *Tsuga heterophylla*, *Larix occidentalis* and *Abies grandis*.

P. benzoinus (Wahlenb.), common in Idaho and Washington on *Tsuga heterophylla*, *Larix occidentalis* and *Abies grandis*, is undoubtedly the same as *P. resinusus* Schrad., on species of *Populus* and *Acer* in the Eastern States.

P. gilvus Fr., thought to be confined to the wood of deciduous trees, is quite common on *Juniperus virginiana* in the vicinity of Washington, D. C.

Polystictus aurantiacus Pk., considered a very rare fungus in the United States, is principally associated with *Pseudotsuga taxifolia* and *Tsuga heterophylla* in Idaho and Washington; the writer has recently collected it from a maple in Idaho.

P. versicolor (L.) Fr., well known on many deciduous trees, has been collected on *Larix occidentalis*, *Pinus monticola* and *Pseudotsuga taxifolia*.

P. cinnabarinus (Jacq.) Fr., occurring abundantly in the North-West

on *Betula occidentalis*, *Acer glabrum*, *Populus*, *Prunus* and *Salix*, has recently been collected on *Thuya plicata*.

P. hirsutus Fr., one of the most common of all polypores on the wood of deciduous trees, has been collected on *Thuya plicata*.

Fomes pinicola, besides occurring on practically every conifer in the North-West, has been found on *Populus trichocarpa*, *P. tremuloides*, *Betula occidentalis*, *Salix lasiandra*, *Alnus tenuifolia*, *Pyrus* *Malus* and a variety of plum; the writer has collected it on *Fagus sylvatica* and *Quercus pedunculata* in Baden, Germany, where it also occurs on *Alnus glutinosa*; Pennington reports it upon *Fagus ferruginea*, *Betula lenta* and *Acer saccharinum* in the Adirondacks, on the balsam poplars of Northern Michigan and on *Prunus serotina*.

F. annosus Fr., which usually attacks conifers, has been collected on various deciduous trees of the North-West.

F. leucophaeus Mont., frequently found on coniferous hosts in the West, is more often associated with deciduous hosts, especially *Populus*.

Lenzites sepiaria Fr., so common on coniferous wood, is frequently found on deciduous trees, among which Spaulding mentions *Alnus* sp., *Populus alba*, *P. deltoides*, *P. tremuloides*, *Salix* sp. and *S. discolor*; the fungus has been collected in the North-West on *Alnus tenuifolia*, *Prunus demissa*, *Betula occidentalis*, *Populus trichocarpa*, *Salix lasiandra*, *Acer glabrum* and *Crataegus Douglasii*; all are very rare hosts, especially the last.

Armillaria mellea (Vahl.) Quél., is common on both coniferous and broad-leaved trees.

Pleurotus serotinus Fr., common on *Alnus* and *Populus*, frequently occurs on *Abies grandis*.

Pholiota adiposa Fr., a serious enemy of *Abies grandis*, occurs also, though rarely, on *Populus*.

Paxillus atrotomentosus Fr., common on coniferous wood, is more rarely found on the wood of broad-leaf species.

PARASITIC AND OTHER INJURIOUS FLOWERING PLANTS.

963 - *Papaver Rhoeas* and *P. hybridum*, Common Weeds in Egypt. (1) — BOLLAND, B. G. C., in *The Agricultural Journal of Egypt*, Vol. IV, Part I, pp. 53-54, plate II. Cairo, 1914.

After recalling the general characters of the genus *Papaver*, the writer gives a systematic description of the two commonest species occurring as weeds in Egypt: *P. Rhoeas* and *P. hybridum*.

The former, known in Arabic as "Zaghilil" and "Qarun", flowers in the winter and spring and is found in waste places and barley fields along the Mediterranean coast.

P. hybridum, in Arabic "Abu el Nôm", flowers in the spring and is found chiefly in the barley fields of the Mariut district.

(1) See also No. 390, B. April 1914.

(Ed.).

This species was noticed by Forkal in his "Flora Aegyptiaco-Arabica" as growing in Egypt in 1775. The word *Papaver* is also mentioned by Prosper Alpinus in his book "De Plantis Aegypti" written in 1640 (1) but no species is given.

INSECT PESTS.

GENERALITIES

964 - Notes on the Biology of Leather Jackets (*Tipula oleracea*) in the Pastures of the Avesnois (Nord, France). — DÉSOL, P. in *Comptes rendus hebdomadaires des séances de la Société de Biologie*, Vol. LXXVII, No. 21, pp. 126-127. Paris, 1914.

During this year (1914) leather jackets have caused serious damage in the pastures about Avesne (Cantons of Bavay and Le Quesnoy). The farmers in this region noticed scattered throughout their fields numerous circular patches of dead yellow grass which did not resume its normal vegetative growth in April. On digging up these dried patches of turf they were found to be swarming with these grubs, especially on a level with the origin of the roots, the majority with their heads almost level with the surface of the soil, others at a depth of from 4 to 5 inches but within the root range of the grasses.

Grasses and clovers are particularly attacked by these larvae whilst plants with larger and tougher roots, such as couch, dock, plantain, Composites, are free from attack. The larvae in the soil bordering on a trench often fall down and being unable to climb out they become heaped several layers deep. They do not migrate from one plant to another but feed almost entirely on the plant near which their eggs were deposited. After the death of the plant they feed on its dead tissues and decaying humus. They are most injurious during their growing period (October to May), especially to plants which live through the winter. This explains why pasture plants are particularly attacked.

Spring-sown crops are therefore less exposed to attack since they do not possess a well-developed root system until May or June when the larvae are entering on the nymph stage.

According to the writer the only practical means of control is to bury the larvae by deep cultivation at the end of winter and to sow a crop in March or April. Spring-sown oats and wheat have grown without damage on infested land treated in this way.

965 - Observations and Researches on the Life History of the Beet *Aphis euonymi* (2). — MALAGUIN, A., and MOTTÉ, A., in *Comptes rendus hebdomadaires des séances de l'Académie des Sciences*, 1914, First Half-year, Vol. 158, No. 19, pp. 1371-1374. Paris, 1914.

In 1913, M. Gaumont recorded deposits of eggs of sexual females of *Aphis euonymi* Fb. on beets, so that according to him this species is able to

(1) According to P. A. SACCARDO: *Cronologia della Flora italiana*, p. XIII, Padova, 1909, the above mentioned work by Alpinus (1553-1617) was published at Padova in 1592.

(2) See also No. 296, B. March 1914.

(Ed.).

complete its life cycle on herbaceous plants. In October 1913 a large number of colonies of this aphid were found on beans and comprised winged males and wingless females; the latter deposited large numbers of eggs on the stems and leaf-stalks. The observations, accompanied by experiments, were carried on to the spring of 1914.

It was found that eggs deposited by sexual females on beans (intermediate host) in the autumn did not hatch, whilst eggs deposited on the principal host, *Euonymus europaeus*, hatched out normally. Further, when the larvae from these eggs were placed on beet leaves, they refused to attack them.

It appears therefore that in the case of a migratory species such as *A. euonymi*, the generation produced from the fertilised eggs is adapted only to the conditions of its principal host, and the adaptation to different food (intermediate hosts) appears in later generations.

966 - **The Emergence from the Soil of the First Larvae of *Phylloxera vastatrix* in Italy.** — G. ASSI, B., in *Rendiconti delle sedute della Reale Accademia dei Lincei, Classe di Scienze fisiche, matematiche e naturali*, 2nd Half-year, Vol. XXIII, Part 2, pp. 19-30. Rome, 1914.

Researches carried out in North, Central and South Italy show that the emergence of the first larvae from the soil before they commence to feed is a normal phenomenon of more general occurrence than was believed by Faucon, who first observed it (1868), and the other authorities who have recorded it. A close examination with the naked eye or a hand lens of loose soil close to diseased stocks is sufficient to reveal their presence.

The emergence of the larvae is more or less abundant throughout the year, except during the hibernation and the period preceding the birth of the first daughter generation of the hibernating females. In Southern Italy they do not appear so frequently from the second half of July to the end of August, the period corresponding with the partial aestivation of the insect.

Considering such a powerful means of distribution of the insect as these first larvae, it is reasonable to suspect that the passing of workmen to and fro in the vineyards is a source of danger. This fact should be taken into account before adopting measures for controlling the disease, when an old centre of infection has been discovered and especially when there is reason to believe that the whole vineyard has become infected.

Researches are being conducted to determine the influence of tillage, the presence or absence of superficial roots, of root development, etc., on the numbers of these first larvae which emerge from the soil. It has already been determined that winter digging is a most effective means of propagating phylloxera over both small and large distances.

It is also affirmed that it is dangerous to examine for phylloxera during windy weather, since a slight wind suffices to carry the larvae from the exposed roots. The necessary precautions to prevent these dangers are too often neglected by the workmen.

- 967 - Notes on *Aspidiotus bromeliae*. — LINDINGER, LEONHARD, and GREEN, E. ERNEST, in *The Journal of Economic Biology*, Vol. 9, No. 2, pp. 73-75. London, 1914.

Contrary to the opinion of Green (1), Lindinger affirms that *Aspidiotus bromeliae* is indigenous to the Azores and not the Canaries. He also adds that as this scale attacks only Bromeliaceae, its original country should be sought in America where these plants (including the pineapple) are indigenous. He also disagrees with Green that this insect may become a serious pest of the pineapple, as its development is too slow.

Green replies that our knowledge of this species is too incomplete to make definite conclusions, since it is not yet known if it is confined to the Bromeliaceae. Further, the Bromeliaceae are indigenous not only to America but also to India, Ceylon, Java and other eastern countries. As to the danger of these scales, Green mentions that the pineapple material from the Seychelles was so badly infested that the health of the plants must have been seriously affected. The rapidity of development of these insects depends so much on the presence or absence of their natural enemies (Coccinellids and Hymenopterous insects) that conclusions based on conditions prevailing in one region may be completely upset by conditions in another region.

- 968 - On the Reproduction and Fertility of the Elm Leaf-Beetle (*Galerucella luteola*). — LÉCAILLON, in *Comptes rendus hebdomadaires des séances de l'Académie des Sciences*, 1914, 2nd Half-year, Vol. 159, No. 1, pp. 116-119. Paris, 1914.

The elm leaf-beetle (*Galerucella luteola*) belongs to the Chrysomelidae and occurs in Europe, Algeria and in the United States. Both larvae and adults feed on the leaves of the elm (*Ulmus campestris*), often causing considerable damage to trees in parks and public places. Sometimes the insect is so numerous that only the veins and petioles of the leaves remain, and when this happens several years in succession the life of the trees is endangered.

The extraordinary abundance of this insect cannot yet be attributed to the occurrence of two generations in one year, but the writer has observed this year on trees near Toulouse and on laboratory specimens that the period of reproduction extends from the beginning of May until early July. The number of eggs in each cluster on the lower surface of the leaf is very variable; the number laid by one female is much greater than was formerly believed, some females reared in captivity having deposited more than 500 eggs. During the period of reproduction the males and females feed abundantly. In the open the females do not lay all their eggs on the same leaf, or even on the same tree. Further, the larvae from one egg-cluster move to different leaves on reaching a certain size.

(1) See No. 798, B. Aug. 1914.

(Ed.).

969 - Winter Precautions against the Pupae of Vine Moths (*Conchylis ambigua* and *Polychrosis botrana*) in Piedmont (1). — TOPI, M., in *Rendiconti delle sedute della Reale Accademia dei Lincei, Classe di Scienze fisiche, matematiche e naturali*, 1914, 1st Half-year, Vol. XXIII, Part 12, pp. 981-984. Rome, 1914.

The writer gives an account of his observations and researches on the control of the hibernating pupae of *Conchylis ambigua* and *Polychrosis botrana*, carried out on several occasions in the Upper Monferrato (territory of Alice Bel Colle), Piedmont, partly in collaboration with F. Monticelli.

The canes generally used for supporting the vines often have the top internode open, thus providing suitable shelters for the larvae seeking places for pupation. For this reason the tipping of the canes and destruction of the tips is recommended, in addition to the stripping of the stocks, which is a laborious operation not without danger.

To determine the value of this tipping, it was necessary to know to what extent the larvae use the tips of the canes for pupation. In a badly attacked vineyard, 25 vines were stripped during the winter and the tips of the canes were examined: the result was 19 pupae in the canes and 18 under the bark. If this is a general proportion, tipping would prevent the emergence of about half the moths, which is not a sufficiently large proportion for a good control; further, the method is laborious.

Better results can be obtained by using artificial shelters, among which the most successful are those described and used by G. Cantoni, in the Trentino. The method consists in placing cloth bands at the base of the shoots on the two-year-old wood; the larvae pupate in these and can be easily destroyed. Where canes are used as supports, they should be tipped, and the bands may be placed on them as well as on the stocks. In a comparative experiment it was found that in this case the stocks were as much used by the hibernating larvae as the canes, or even more so.

These measures can be made more effective if the bands containing the pupae are placed in special cages to allow the escape of any Hymenopterous parasites that may be present, but not the moths. Out of 100 cocoons, 57 moths and 22 Hymenopterous parasites were obtained; the rest of the pupae were attacked by fungi and a few cocoons were empty. If they had been in the open, a certain number of pupae would no doubt have been destroyed by animals, fungi and other causes. Frequently a species of *Helops* and the larvae of *Malachius bipustulatus* are found in the ends of the canes, and though they are believed to prey on the pupae, their usefulness and voracity must be considered highly doubtful.

The writer remarks on the preponderance of *Polychrosis*, since out of the 57 moths mentioned above, 54 were *Polychrosis* and only 3 *Conchylis*. In the catch of molasses traps the number of *Conchylis* was appreciably larger, namely 10 to 73 *Polychrosis*; possibly *Conchylis* was abundant locally in the district in which these researches were made.

970 - The Fumigation of Citrus Trees in Egypt. — GOUGH, LEWIS, in *The Agricultural Journal of Egypt*, Vol. IV, Part I, pp. 17-19. Cairo, 1914.

After having mentioned that citrus trees in Egypt are subject to the attacks of several species of scale insects (1) among which the most important are *Aspidiotus aonidium* (?), *A. aurantii* and *Icerya purchasi*, Dr. Gough describes the system of control which has been adopted and which is carried out only by the Government and which consists in the well known process of fumigation with hydrocyanic acid.

INSECTS
INJURIOUS
TO VARIOUS
CROPS

971 - The Principal Pests of Rice in Indo-China. — DUPONT, L., in *Journal d'Agriculture tropicale* Year 14, No. 157, pp. 204-207. Paris, 1914.

I. INSECTS. — The writer gives some information on the following insects injurious to the rice crop.

a) Lepidoptera. — 1) *Sesamia inferens* Wlk., the young larvae of which enter the upper portion of the stem and bore their way to the base, where they frequently pupate; the pupae are easily destroyed in great numbers by raising the level of the irrigation water so that they become submerged. A certain number of larvae, however, always ascend the stem to pupate. As many as ten pupae have been found in one stem. This species, already recorded in India, Java, Tonking, etc., caused great damage to the rice crop in the state of Pahang (Federated Malay States) in 1906.

2) *Schoenobius bipunctiferus* Wlk., the larva of which, on leaving the stem, protects itself with a fragment of the leaf until it returns to pupate at the base of the stem; the moth emerges after 10 or 15 days. It has caused great damage in the Philippines and occurs in Java, Tonking, etc.

3) *Cnaphalocrocis medinalis* Gn., is the commonest padi borer; after boring the upper portion of the stem, it gradually works its way to the base. Its presence is indicated by an empty panicle of a blanched appearance, later turning ashy grey or dark grey on the development of saprophytic fungi. The damage due to this insect may vary from 5 to 25 per cent. It is kept in check by cutting the diseased stems as low as possible, soon after the appearance of the panicles, and destroying them without delay, or by ploughing in the stubble immediately after harvest. This species has been recorded in India, Java, and Tonking.

4) *Artana walkeri* Moor.; this seems to be the first record of this species as parasitic on rice; in 1911 it caused considerable damage in the province of Thai-Nguyen, and it was recorded in the neighbourhood of Hanoi in 1913.

5) *Sitotroga cerealella* Oliv.

b) Hemiptera. — 1) *Leptocoris varicornis* Fabr. is widely distributed at all seasons of the year. It sucks the milky contents of the young grains. When they occur in large numbers they may be kept in check by sweeping with nets of fairly large mesh. It is also useful to destroy the grasses

(1) See No. 1485, B. Oct. 1912.

(Ed.).

which grow in the neighbourhood of rice fields. *Cicindela sexpunctata* is a very effective and abundant natural enemy of this pest in Tonking.

2) *L. acuta* Thumb., which causes similar damage, is widely spread in the Philippines; in 1909 it caused serious damage to the rice fields in Ceylon.

II. FUNGI. — Finally the writer mentions two fungi: *Ustiliginioidea virens* Tak. and *Tilletia horrida* Tak. (1).

The former, restricted to rice, is common in Tonking, the ten-months' rice being most particularly attacked. Near Hanoi as many as 15 diseased grains have been found on one panicle by the writer. It is most abundant in rice fields which are badly cultivated. The infested grain swells and assumes a yellowish-green colour more or less intense according to the development of the disease; it soon becomes a dull green velvety mass covered with spores, from 6 to 10 mm. in size and darkening in colour until almost black, whilst its surface disintegrates and falls to dust: beneath the greenish-black dusty layer of spores there remains a small very hard, orange-yellow mass with a hard white centre. The fungus is common in Japan, China, etc.

Tilletia horrida also attacks the grains in the panicle, converting them into a black powdery mass of spores. The writer has observed it on ten-months' rice near Hanoi and in the province of Phu-Yen. It is much rarer than *U. virens*.

972 — The Mole Cricket (*Gryllotalpa vulgaris*) damaging Rice Fields in Italy. — NOVELLI, N., in *Il Giornale di Riscoltura*, Year IV, No 13, pp. 189-193. Vercelli, July 15, 1914.

The writer records that the mole cricket occurs in increasing numbers in certain irrigated rice-growing districts in Italy, where the conditions are undoubtedly very favourable to its development.

It causes considerable damage and the writer has seen entire fields almost devastated by the insect. Wheat, oats and barley have been badly thinned and maize reduced so as to require re-seeding. Where the crops were drilled the damage was worse, since the crickets follow along the lines more easily. Close to the banks dividing the rice plots in the previous year, the damage is always complete; wheat or maize following grass is always greatly thinned and market garden crops are very seriously damaged. Dry land rice is attacked similarly to wheat; and in ordinary cultivation they come down from the banks to devour the rice when the water is run off, especially at the first drying. The banks often become so infested by these insects that their resistance to water becomes seriously impaired, the escaping water giving rise to so-called cold spots below, where the rice remains stunted.

The writer points out the importance of adopting measures against this pest without delay and recommends the following: a) summer cultivation in the irrigated regions, so as to interfere with the development of the insect, and destruction of the nests by children or labourers following

(1) See No. 992, B. March 1911.

(Ed.).

the plough: stamping on them is sufficient to destroy the eggs or young larvae; *b*) early ploughing of the leys intended for wheat, maize, etc., followed by a second ploughing before sowing; *c*) searching for the insects during the irrigation of the fields: as the water rises they leave their burrows and collect on the higher ground, many swimming to the banks, where they can easily be destroyed; *d*) searching for the insects and their nests in the banks, or injection of carbon di-sulphide in holes 8 inches or more deep and 30 inches apart, or watering the banks with 20 per cent. petroleum emulsion: any insects which come out on the surface as a result of these treatments can easily be destroyed under the feet.

973 - Sweet Potato Sphinx (*Herse convolvuli* ?) in Natal. — FAURE, J. C., in *The Agricultural Journal of the Union of South Africa*, Vol. VII, No. 4, pp. 515-519, fig. 1. Pretoria, 1914.

The sweet-potato industry in the New Hanover-Dalton District in Natal has increased rapidly in recent years. There are probably about 2000 acres under sweet potatoes every year, and the gross value of the crop is about £20 000.

In November 1913 reports from the district came in about severe injury to the crop caused by a larva which the writer refers doubtfully to *Herse convolvuli* L. It devours the leaves of the sweet potatoes, causing a loss which is estimated at from 25 to 50 per cent. and even more. One 17-acre field was severely infested and the whole of it was practically defoliated in the course of a week.

Growers are of opinion that there are three occurrences of the larvae every season, one towards the end of November, one in January and another in March. The January infestation seems to be that most feared. At Schroeders in Natal the insect has been known for the past twenty years.

The writer gives the following information on the life-history of the sphinx: the eggs are laid singly on the under sides of the leaves: the larvae show a great variation in colour and markings, the majority, however, being dark brown; pupation takes place in the soil.

From dead larvae Tachinid flies have been reared, as well as a small Chalcid which might be a hyperparasite.

The experiments carried on at Schroeders on a small scale indicate that the sphinx can be readily controlled by the use of arsenical sprays. Paris green gave the best results, but arsenate of lead will probably also answer the same purpose. The former was used at the rate of 1 lb. to 2 lbs. of lime and 75 gallons of water, and arsenate of lead at the rate of 3 lbs. to 50 gallons. The mixtures were sweetened in both cases. From 30 to 80 per cent. of the larvae were thus killed and besides this the sprayed areas were markedly avoided by migrating larvae. Hand-picking will probably be very successful on a small scale, and since the insect hibernates in all probability as a pupa in the soil, thorough winter ploughing and harrowing may destroy many of the pupae and thus aid in the control of the pest. During their migrations the caterpillars might be killed by digging ditches for them to collect in or by the use of poison bait spread across their line of march.

974 - Large Narcissus Fly (*Merodon equestris*) and Small Narcissus Fly (*Eumerus strigatus*) Injurious to Bulbs in Great Britain and Ireland. — Board of Agriculture and Fisheries, Leaflet, No. 286, pp. 1-7, 1 plate. London, 1914.

Of the various animal pests attacking the bulbs of Narcissi and related plants, none are more injurious than the two Narcissus flies, *Merodon equestris* F. and *Eumerus strigatus* Flu. The former, often known as the Large Narcissus Fly has been known in England since 1869, and is now widely distributed in England and Wales, while it also occurs in many parts of Scotland and in Ireland. It is generally supposed to have been brought to England, probably from Holland, but in the opinion of others it is considered to be native.

The systematic description of the insect is given in the leaflet together with its life history.

The bulbs attacked include the Narcissus, Hyacinth, Tulips (rarely), Amaryllis, Habranthus, Vallota, Galtonia, Scylla and Leucojum. As regards Narcissus, it has been observed that the hard bulbs of the *N. maximum* and *N. spurium* type are least attacked, while the most susceptible are the *N. poeticus* and *N. Ledscii* varieties, and, further, that varieties with coloured cups are more susceptible than those without.

The interior of the bulbs is hollowed out, a wet mass of frass and decayed matter only remaining. The decay due to *Merodon*, however, does not cause such a complete breakdown of the bulb as in the case of an attack by *Eumerus*.

When the larvae are large the infested bulbs can be detected by gently pressing near the neck with the fingers: sound bulbs being hard, and infested ones less resistant. When the larvae are young, it is much more difficult to be sure of their presence, but it is said that any bulb in which the basal ring is incomplete or damaged should be regarded with suspicion.

When a number of bulbs in a row fail to appear in the spring, those which have missed should be searched for and destroyed. Bulbs should be lifted in summer and all found to be infected should be destroyed. Bulbs may be steeped in water for from 24 to 48 hours. The water should be just warm, and if possible should not be allowed to become very cold in order not to injure the bulbs. The steeping seems to make the bulbs swell, so that the larvae are forced out or drowned, though they can live for many days when immersed. This treatment has been found very effective. Netting the flies with a butterfly net has been found quite successful in gardens.

The Small Narcissus Fly (*Eumerus strigatus*) has been only recently recognized as seriously injurious to Narcissi; it attacks also Hyacinths, Onions and Shallots (the two latter only on the Continent).

The systematic description of this insect, as well as its life-history, which has not yet been completely traced, are given in the leaflet.

In an advanced stage of the attack the interior of the bulb is entirely destroyed and is full of a semi-liquid decaying mass. The attack seems to begin at the neck, and in mild cases the larvae are found in the neck or under the scales at one side. The presence of many larvae and the complete

decay produced distinguish the damage done by *Eumerus* from that done by *Merodon*.

The destruction of affected bulbs when lifting is obviously indicated, and since the decay produced is rapid there is little difficulty in recognizing them. Early lifting also seems desirable to destroy the larvae before the emergence of the second brood.

The larvae of several other flies are frequently found in bulbs decaying from other causes, but they do not appear ever to start an attack on a healthy bulb. The commonest species are *Lonchaea chorea* and species of *Scatopse* and *Sciara*.

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The Bureau assumes no responsibility with regard to the opinions and the results of experiments outlined in the Bulletin.

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FIRST PART.
ORIGINAL ARTICLES

The Grass and Clover Seed Industry in New Zealand

by

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New Zealand Agriculture is not conspicuous for harvested crops. The area devoted to them is insignificant when compared with that utilized for grazing or feeding-off by stock. During the season 1913-14 less than eight hundred thousand acres out of a total of forty odd million acres that are under occupation were utilized for the production of all kinds of harvested produce, including hay. Less than one per cent of the sown grasslands are annually cut for hay, and this gives a very clear indication of the small provision that need be made in New Zealand for the production of stored winter feed. As, comparatively speaking, no exportation of cereals takes place, the reason for the minor position of annually harvested crops is readily explained. Of the 800 000 acres employed in their production, over 100 000, or more than 12 per cent., were devoted to grass and clover seed. Thus the growing of "pasture seeds" occupies quite an important position amongst the minor agricultural industries; in point of view of both acreage and value of production, pasture seed raising ranks third in importance (after oats and wheat) and far exceeds in value the hay crop.

Although New Zealand is eminently adapted for the successful production of all kinds of pasture seeds a large quantity is annually imported. This is due to the fact that the utilization of land purely for growing pasture seeds is rarely attempted, and unless the growing of a comparatively pure crop of any grass or clover will fulfil other functions besides that of producing a seed crop its cultivation is not entertained. The only grasses that are grown on any extended scale purely for seed production are

Crested Dogtail and Western Wolths Ryegrass ; in nearly every other case the primary object in the laying down of grassland is the securing of either temporary or permanent pasturage. Whether or not the grassland will be shut up for seed depends on the market prospects and whether the farmer intends to stock the whole of his grazing area fully during the summer. The profit to be made by temporary fattening is in most cases the deciding factor. Thus grass and clover seed raising can in New Zealand be looked upon as really a bye-product of pasture land made use of when it appears to be more profitable to let the seed mature than to feed off the growing herbage with grazing animals for the elaboration of mutton, beef or butter fat. It would thus be surmised that the main pasture seeds produced in the Dominion would be those that comprise the dominant elements of the ordinary pastures. This surmise would be quite correct : the two main grass seeds produced are those of Ryegrass and Cocksfoot, which represent the two main grasses used in pasture formation and which form the dominating elements in the majority of the sown grasslands of New Zealand.

The demand for "pasture seeds" in New Zealand is large and probably no other country in the world uses a larger variety in the laying down of permanent pastures. The formation of permanent pasture is one of the most important features of New Zealand agriculture. There is no natural grassland that in any way corresponds with true pasture and the grasslands of New Zealand can be sharply divided into two classes : the natural grasslands and the sown grasslands. The former are characterized by the dominance of tall, densely tufted tussock grasses, belonging to the genera *Poa* and *Festuca*, growing at more or less regular intervals from one another and never making a compact sward capable of being mown. The sown grasslands are characterized by consisting almost entirely of European pasture grasses belonging mainly to the genera *Dactylis*, *Lolium*, *Festuca*, *Agrostis* and *Holcus*, and forming in most cases a uniform sward kept closely cropped by grazing animals. The sown grasslands comprise some 17 million acres, of which about four million consist of leys with a duration of from 2 to 7 years, the remainder being permanent pasture. Each year about one million acres are sown down in temporary and permanent pasture, the area in the latter being steadily increased through the conversion of native vegetation, mainly forest, into grassland. As roughly over 25 pounds of seed is used per acre, the annual consumption of pasture seeds is roughly about 12 000 tons.

Although a very large variety of grasses and clovers are sown in New Zealand, only a few are grown for seed purposes in sufficient quantities to satisfy the local demand. These are the following :

1. Perennial Ryegrass (*Lolium perenne*).
2. Italian Ryegrass (*Lolium italicum*).
3. Cocksfoot (*Dactylis glomerata*).
4. Chewing's Fescue (*Festuca saburicola*).
5. Danthonia (*D. pilosa* and *D. semiannullaris*)
6. Ratstail (*Sporobolus indicus*).

7. Prairie grass (*Bromus unioloides*).
8. Reed Fescue (*Festuca arundinacea*).
9. Yorkshire Fog (*Holcus lanatus*).
10. Suckling Clover (*Trifolium minus*).
11. Boyd's Clover (*Lotus angustissimus*).
12. Lucerne (*Medicago sativa*).

The following are regularly produced, but in insufficient quantity to cater fully for the local demand :

1. Crested Dogtail (*Cynosurus cristatus*).
2. Meadow Foxtail (*Alopecurus pratensis*).
3. Red Clover (*Trifolium pratense*).
4. White Clover (*Trifolium repens*).
5. Birdsfoot Trefoil (*Lotus uliginosus*).
6. Western Woads Ryegrass (*Lolium italicum* var.).

Grasses and clovers that are regularly used in the laying down of pasture but which are rarely harvested in any appreciable amounts are the following :

1. Kentucky blue grass (*Poa pratensis*).
2. *Poa trivialis*.
3. Timothy (*Phleum pratense*).
4. Sheeps Fescue (*Festuca ovina*).
5. Red Fescue (*Festuca rubra*).
6. Hard Fescue (*Festuca duriuscula*).
7. Meadow Fescue (*Festuca pratensis*).
8. Fiorin (*Agrostis alba*).
9. Red Top (*Agrostis vulgaris*).
10. Brown Top (*Agrostis canina*).
11. Paspalum (*Paspalum dilatatum*).
12. Alsike (*Trifolium hybridum*).
13. Trefoil (*Medicago lupulina*).

It will be noted that nearly all the recognised pasture grasses of Europe are made use of, with the notable exception of Tall Oat Grass (*Arrhenatherum elatius*) ; although fairly widely naturalized, it is not used in New Zealand agriculture.

THE MAIN PASTURE SEEDS HARVESTED.

Perennial Ryegrass. — About 50 000 acres are annually cut for seed. The majority is harvested from pastures of short duration, although a proportion is procured from permanent pastures. In many parts, notably on the east coast of the South Island, it is a regular practice to crop land for a season or two with annual crops and then lay it down in Ryegrass. White and Red Clover ; it then remains in pasture until such time as the land is again required for cropping and during this period several crops of seed may be taken off. The permanent pastures of Ryegrass are mostly found in the North Island and if not required for fattening purposes a seed crop is harvested in certain cases annually. In most cases stock are exclu-

ded for about three months of the year, but in certain instances the land may be lightly stocked even after it has been decided to harvest a seed crop. The crop is generally cut with a reaper and binder, but a stripper may be occasionally employed. The yield varies from 400 to 600 pounds per acre. The land from which the seed is harvested is ordinary pasture in which Ryegrass, although dominant, is only one of the elements of the association; as no cultural methods are adopted the harvested product contains a large proportion of seeds other than Ryegrass. Thus the cleaning of the harvested seed is a very important matter and in some instances a loss of over 50 per cent. by weight is experienced in the dressing, although as a rule 25 per cent. may be looked upon as the average. The cleaning is done by power machines; in most cases rotary riddles of varying mesh are employed for removal of the extraneous seeds, and winnowing is also utilized for the extraction of light seed. The bushel weight varies from 26 to 36 lbs. and 30 lbs. is looked upon as the minimum bushel weight of first-class machine-dressed seed. The germination of high grade seed is over 90 per cent., and 75 per cent. is the average of all lines. The total crop sometimes exceeds 8 000 tons of dressed seed, and nearly the whole of this is used locally, only a comparatively small quantity being exported and that mainly to Australia.

It is difficult to determine the amount of *Italian Ryegrass* produced, as there are no separate figures for this crop, but 1 000 tons would be a moderate estimate. The yield of Italian is on the whole higher than that of Perennial Ryegrass, and the bushel weight is rarely more than 23 pounds. In most cases the purity of machine-dressed seed is low, owing to the large amount of Perennial Ryegrass that is generally present in the pastures from which the seed is harvested.

Cocksfoot. — An average of 30 000 acres is annually harvested. The main quantity of seed is produced on steep hillsides on Banks Peninsula in the South Island and is termed "Akaroa" Cocksfoot. Cocksfoot is also harvested by machines from level pastures of Cocksfoot and Ryegrass, when it is termed "Plains Cocksfoot", and even after machine dressing may contain as much as 30 per cent. of Ryegrass. All the hillside Cocksfoot is cut and threshed by hand labour and each man is paid from 1s 3d to 1s 6d per hour. The bushel weight of machine-dressed seed varies from 14 to 20 pounds, 16 lbs. being looked upon as the standard. The average yield is about 160 lbs. per acre and the loss in cleaning averages 20 per cent. Machine-dressed seed of 16 pounds bushel weight generally contains less than 3 per cent. of extraneous seeds (consisting mainly of *Holcus lanatus* and *Hypochaeris radicata*) and about 10 per cent. of empty and semi-empty husks. The germination of the *pure* seed averages about 84 per cent. The annual crop occasionally exceeds 2 000 tons of dressed seed. A considerable amount of Cocksfoot is exported to Europe, and for years New Zealand seed was looked upon as superior to that from any other country; at the present time, however, Danish seed is looked upon with more favour than formerly, and threatens to supersede New Zealand on the European markets unless our local seed is cleaned to a higher standard than is at

present adopted. The price of labour is now so high in New Zealand that the margin between the cost of the undressed seed and the average price for dressed seed in Europe is too small to allow of any more loss in cleaning than is now experienced.

Chewing's Fescue (*Festuca saburicola*). — About 6 000 acres are annually harvested in the southern portion of the South Island. The yield averages about 400 lbs. per acre. As Chewing's Fescue forms one of the purest of the New Zealand pasture associations, the amount of extraneous seeds is not great even in undressed samples, but seed of this fescue, like many other species of the genus, contains a large percentage of empty husks, and thus the loss in cleaning is often very great. A large proportion of the seed is exported to Europe where it is sold under the name of New Zealand Red Fescue. The germination is generally high and when harvested under good conditions averages over 85 per cent.

PASTURE SEEDS HARVESTED IN SMALL QUANTITIES.

Besides the four grasses mentioned, a number of others are harvested in limited quantities. The most important of these is *Crested Dogtail*, which is occasionally produced in sufficient amount to more than satisfy the annual local demand of about 150 tons.

Clovers are not extensively harvested and roughly about 3 000 acres are cut for seed. The most important is *Red Clover*, nearly always sold under the name of Cowgrass, but the quantity produced is never sufficient for local requirements. The large number of species that are regularly sown but not grown for seed is peculiar, but is explained by the fact that none of them normally occupy a dominant position in any type of pasture, although the majority are generally distributed throughout the majority of our sown grazing land. Wherever a pasture consists mainly of a single species it may be shut up and harvested for seed; thus in certain instances such grasses as Meadow Foxtail, Danthonia, Prairie grass and Reed Fescue may be harvested in quite large amounts. In very few instances, however, is the pasture laid down with the express intention of utilizing it for seed production, but the conditions being favourable for the final development of a comparatively pure association of a single species the production of a seed crop of that particular species becomes profitable and this practice is then adopted.

SEED CLEANING.

There are two systems in vogue with regard to the cleaning of grass and clover seed. In the first one the merchant pays so much per pound to the farmer for his seed in the rough, *i. e.* uncleaned. In the other the merchant pays a certain price for the seed after it has been dressed and brought up to a specified purity and bushel weight. When seed is bought in the rough the merchant puts it through the cleaner, of which he is generally the owner, and utilizes any bye-products that may result. When the merchant buys machine-dressed seed the farmer has to pay for the

cleaning and is credited with the value of any bye-products that are of any commercial value. The price paid for cleaning varies with the kind of seed that is being dealt with. Ryegrass generally costs 3d for every 20 pounds put through the machine, and Cocksfoot and Chewing's Fescue about $\frac{1}{4}$ d per pound, while Crested Dogtail generally averages about $\frac{1}{2}$ d per pound. The price charged for clover cleaning varies according to the purity to which it has to be dressed, but $\frac{1}{2}$ d per pound is about the average price in vogue.

The large amount of impurities that are general in New Zealand harvested grasses and clovers, due to the utilization of ordinary mixed pasture for their production, has necessitated the invention of many mechanical devices in order to produce a clean line. The majority of the seed-cleaning machines in use are manufactured locally and have been specially designed to suit local requirements.

BYE-PRODUCTS OF SEED CLEANING.

The main object of seed cleaning in New Zealand is the more or less total removal of all extraneous seeds. It is not unusual for many lines to contain large quantities of extraneous seeds that have a commercial value and many of the cleanings are re-cleaned and sold. In many instances the value of the bye-products of the machine cleaning are sufficient to cover the cost of dressing the original seed, and in certain instances the bye-product may be more valuable than the seed that is being dealt with. The main grass and clover seeds of commercial value found in cleanings are as follows:

1) Yorkshire Fog (*Holcus lanatus*). — A bye-product of most grass seeds in New Zealand. Although Yorkshire Fog is only intentionally sown in certain situations, it is a regular constituent of nearly all pastures. The covering glumes are always removed in the cleaning process and the re-cleaned article is quoted as "shelled Fog". The majority of the seed is exported to Europe and Australia.

2) Suckling Clover (*Trifolium minus*). — Like Yorkshire Fog, Suckling Clover is a regular constituent in all pastures although it is rarely intentionally sown. The seed is all exported to Europe and is most probably used as an adulterant in White Clover. It is significant in this respect that the brighter the sample the more readily will it sell, while dark coloured lines, even though the germination and purity may be excellent, are comparatively unsaleable.

3) White Clover (*Trifolium repens*). — White Clover is frequent in undressed Ryegrass seed and whenever it occurs in appreciable quantities is re-cleaned. It is generally of excellent quality and is often used to mix with imported lines to improve the colour. In certain instances undressed Ryegrass may contain as much as 25 per cent. of White Clover.

The major portion of the cleanings from New Zealand seed consist of Sorrel (*Rumex Acetosella*), Goosegrass (*Bromus hordeaceus*), Catsear (*Hypochaeris radicata*) and Sweet Vernal (*Anthoxanthum odoratum*), while

during certain seasons large amounts of Ergot sclerotia are removed from Ryegrass. None of these have any commercial value, although at times certain of the cleanings are ground up and incorporated into stock feeds. In general, however, the majority of the cleanings are burnt.

ADULTERATION OF SEED.

Comparatively no adulteration of pasture seeds occurs in New Zealand. In certain instances Chewing's Fescue (*Festuca saburicola*) may be sold under the name of Sheep's Fescue (*Festuca ovina*) and occasionally Suckling Clover (*Trifolium minus*) is added to lines of White Clover. Formerly Cocksfoot was sometimes adulterated with either Ryegrass or Chewing's Fescue, but this practice is now rare. The mixing of different grades of the same species is, however, not uncommon. This refers more particularly to Ryegrass, where a low and a high germinating line may be mixed together in about equal amounts. There are many lines of New Zealand grown grasses on the market that contain a very large percentage of extraneous seeds, but these are in no case examples of adulteration. They simply represent seed that has not been properly dressed and has been harvested from mixed pasture in which a single species, although the dominant element of the association, may not occupy more than 70 per cent. of the ground. Ordinary machine-dressed seed, with the exception of Italian Ryegrass, however, is nearly always of high purity so far as freedom from extraneous seeds is concerned. Seed cleaning has in New Zealand been raised to a fine art and the standard set by seed cleaners is so high that so far as purity is concerned, machine-dressed local seed compares more than favourably with that imported.

The Present Condition of Forestry in Hungary

by

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Forest Legislation. — The forest law XXXI, of 1879, marks an important point in the history of Hungarian forest economy. This law, made necessary by the devastation and progressive diminution of the forests between 1850 and 1870, gave wide powers to the State, though at the same time respecting the rights of private property. After the abolition of servitudes and the development of small freeholds, large extents of forest fell into the hands of peasants who knew little about their management, and either cleared them for cultivation or ruined them by excessive grazing. At the same time the economic development which started in 1870 and the improvement in means of transport due to railway construction, both increased the demand for wood and facilitated heavy exploita-

tion of the forests. It was thus essential for the State to take energetic action to check the constantly increasing deforestation.

The clauses of the forest law, or *forest code*, as it may well be called, provide for the maintenance of forests in the interests of public economy and take full consideration of the question of situation and soil, dealing with protection forests, forests on shifting sands and those on soils which could not be profitably used for other types of cultivation (arable or grass land, gardens or vineyards). In the forests of the first type, clearing and clear felling are prohibited: in those of the other two types only clearing. Further, removal of litter is prohibited in protection forests and forests on shifting sands; and in these types grazing is not allowed when it might result in damage to the trees, the young growth or the soil.

The clauses relating to rational exploitation of the forests refer to forests owned by the State, by "jurisdictions" (1), by communes, by religious bodies and by the clergy; as well as to forests under the control of special foundations and held in trust; also to "compossessoral" (2) forests, which include those which, under the "urbairal rule" (3), have become the property of the former vassals. Lastly, these clauses are also applicable to forests belonging to limited companies founded for working mines or for other industrial undertakings. The forest law imposes the exploitation of the forests mentioned according to the plans for systematic management (Art. 17), and prohibits the employment for the purpose of persons other than forest agents who have been through a special technical training (Art. 21).

The forests of the Kingdom of Hungary occupy an area of 22 113 950 acres, which is 27 per cent. of the total area of the country. Of this area, Hungary proper with Fiume possesses 18 332 010 acres (26 per cent. of its total area), while Croatia-Slavonia contains 3 781 940 acres (35 per cent. of the total area). Under the forest law, the various forests are submitted to plans of management according to their nature as shown in Table I.

As the owners of communal and other forests could not themselves bear the expenses entailed by the plans of management without burdening their estates with a mortgage out of proportion to their incomes, it was necessary to make the provisions of the forest law capable of practical application. For this purpose, law XXXI of 1879 was supplemented by law XIX of 1898, by virtue of which small and large communes possessing forest property of an area of at least 5 000 arpents (7 110 acres) only have the right of maintaining forests at their own expense if they can include in their budgets the sums necessary for the management of the woods, and if the exploitation proves profitable. If this is not the case, all these forests,

(1) This is the title given to bodies, counties and free or royal boroughs which formerly had the right of holding courts of justice.

(2) A "Compossessorate" is a meeting of nobility who hold in common certain lands which remain in the family without division.

(3) This rule was established to allot to the peasants of every territory certain lands, which they received either in exchange for rights of usage or by purchase from the owner.

TABLE I. — *Classification of forests for management.*

	Hungary proper with Fiume — acres	Croatia- Slavonia (*) — acres
<i>According to the type of land:</i>		
Protection forest	744 370	88 820
Forests on shifting sands	274 860	709
Forests on true forest land	14 951 320	1 985 732
Forests on land not confined to forest use . .	2 361 459	1 706 680
<i>According to the ownership:</i>		
State	2 809 801	820 516
Jurisdiction. Communes	3 051 241	393 517
Religious bodies, the clergy	1 193 006	90 908
Public foundations	190 767	—
Private foundations	14 775	—
In trust	1 345 130	—
Commossessorates	2 754 736	1 469 853
Limited companies	311 618	47 579
Total submitted to the forest law	11 671 075	2 822 374
Private property	6 660 934	959 567

(*) The forests of Croatia-Slavonia are submitted to the system of management established by the special law of 1894 and 1895; the regulations concerning fruition and exploitation agree in essentials with those of the law XXXI of 1879.

as well as those to which art. 17 of the law of 1879 refers, shall be under the State Forestry Department.

For the administration of the forests, the owners are required to pay an annual tax. In 1912, the State administered 16 710 forest estates with an area of 5 058 432 acres. The taxes paid by the owners amounted to 792 503 crowns (£33 021), as against 2 664 142 crowns (£111 006) for the expenses of the State.

The provisions of the above-mentioned laws, as well as the data given above, show on the one hand that these laws ensure the preservation and maintenance of forests situated on land unsuitable for other cultivation, and on the other hand that they guarantee systematic exploitation controlled by the authorities to such an extent that the forests under uncontrolled exploitation represent only a very small portion of the total area of forest in Hungary. Considering the unsystematic exploitation of the preceding period, this restriction was very necessary to the forestry of Hungary; moreover, it should continue to be so, for although as regards forest area our country occupies a very good position, many of the Hungarian forests contain a relatively small bulk of standing timber, and consequently do not afford the permanent and uniform production of normal forests.

Distribution of forests and species of trees in the different parts of Hungary. — As most of the forest regions of Hungary extend along the Carpathians and their spurs, they bear the characteristics of the medium and high mountain types. In the northern forest region are found pine, silver fir, spruce and beech. The regions of the east (Eastern Hungary and

Transylvania) and the south-east, are for the most part covered with beech, silver fir and oak being of less importance. The forest region of the west is situated on the right bank of the Danube upon the slopes of the mountains of intermediate altitude; here, the principal trees are beech and oak, together with Scots pine. The region between the Danube and the Tisza, *i. e.* the Alföld, which extends to the southern frontier of the country, is the least rich in woods; here, oak and beech play only an unimportant part, and pine is almost absent; on the other hand, false acacia is found and in some places willows and poplars. In general, the forests of Hungary consist of trees belonging to the Central European flora. The respective percentages are given in Table II.

TABLE II. — *Percentage areas occupied by the different trees in Hungary.*

Beech	36.11
Oaks (<i>Q. Robur</i> [<i>pedunculata</i>] and <i>Q. sessiliflora</i>) . . .	21.04
Turkey oak (<i>Q. Cerris</i>)	5.64
Spruce	14.34
Silver fir	4.34
Hornbeam	9.03
Birch	2.34
Poplars and willows	2.16
Ashes, elms, maples	1.42
False acacia	1.00
Scots pine	1.99
Larch	0.06
Alder	0.45
Limes	0.08

There are also found, although rarely, Austrian pine (*Pinus austriaca*) and stone pine (*P. Cembra*).

The area of 22 113 950 acres under forests in the Kingdom of Hungary is distributed as follows:

	Hungary proper with Fiume acres	Croatia-Slavonia acres
Beech and other broad-leaved trees . .	9 084 023	2 520 175
Oaks	4 872 504	331 377
Conifers	4 375 483	430 389

Hungary possesses more beech than can be profitably used. Although beech is finding increasingly wide uses, the practice has been adopted, as a principles of forest economy for special cases, of substituting oak, pine or silver fir for it.

Forest Management. — More than 65 per cent. of the forests of Hungary are high forest; the rest are coppices, of which a very small portion are with standards. In some places, in consideration of the grazing rights, the system of grazing-forests has been maintained. The spruce and oak forests are mostly exploited by clear felling with artificial regeneration of the cleared

ground, while in forests of silver fir and mixed forests the system of gradual felling obtains. In beechwoods either system is practised, according to the requirements of natural regeneration. In protection forests, and in some other places, in order to ensure regeneration and to guarantee the productivity of the soil, selection felling obtains. Coppice growing is practised especially in the smaller forests, sometimes also for the production of tan bark; further, in the poplar and willow plantations and in *Robinia* forests which cover the Alföld. In the high forests, the rotation varies between 80 and 120 years; in the coppices, between 10 and 60 years.

The work of reafforestation. — In the system of the reafforestation of forests which have been cleared, artificial regeneration plays an increasingly important part. The Government shows great activity in all that concerns the replanting of the communal and other forests submitted to its management. Further, to assist regeneration, it encourages and favours the work of private individuals by means of grants, State premiums and the annual distribution of large quantities of young trees; these are supplied either gratuitously or at a low price. The forest law of 1879 having established a National Forest Bank, maintained by fines for the infraction of regulations, its funds are destined, for the most part, to provide premiums and subsidies, and for carrying out useful forestry work. A considerable sum from the budget of the forests exploited by the State goes also to the creation of nurseries and to reafforestation. Further, a large sum is devoted from year to year to the regeneration of bare and eroded areas. Finally, the forest directions and the Treasury forest offices, as well as the foresters' schools, distribute a large number of trees for reafforestation purposes.

The following data afford an illustration of what I have just said: In 1912, the State gave 30 different premiums of the value of 15 000 crowns (£ 625) for the reafforestation of bare land effected independently of the State; further, 1039 poor proprietors received grants of £ 6 390 for reafforesting 6 754 acres of bare land; four nurseries (116.4 acres) of the special foresters' schools furnished 6 986 000 young trees; 186 nurseries (1360 acres) administered by the forest offices provided 64 586 000 trees. Of these trees 37 265 000 were distributed free to 2101 proprietors. From nurseries with an area of 845 acres managed by the owners at their own expense, 46 million trees were used for reafforestation. Finally, 1 609 000 young trees were handed over to private individuals by the forest authorities of the Treasury. In 1912 the areas planted were:

	acres
Land to which art. 17 of the law refers	138 218
Private land	13 522
Land not prescribed for reafforestation	6 766
Total	158 506

A further 74 908 acres remained unplanted on account of unfavourable climatic conditions, deficiency of seeds and want of labour.

In 1913, the National Forest Bank gave £ 2 651 8s for reafforestation. According to the budget of the communal forests, etc., a sum of £20 400

was devoted to the same object. Further, a sum of £54 000 was granted for the reafforestation of bare and eroded land.

We should also note that for a number of years the labours of the State in the domain of forestry, especially in that of afforestation, have been crowned with success : thus the replanting of the moving sands on the borders of the towns of Szabadka and Szeged amongst others, and the fixing of the moving sands of the Puszta Déliblát, constitute remarkable performances of Hungarian forestry and are also well known abroad.

Exploitation of forests and utilization of timber. — The timber felled on moderate sized forest estates is, for the most part, used by the proprietor for his domestic and agricultural requirements, so that only the larger estates are in a position to market timber ; this not only serves to satisfy the demands of the country, but also gives rise to an export trade.

The most valuable tree is oak, furnished by the forests of Eastern Hungary, Transylvania and Slavonia ; these oak woods enjoy a world-wide reputation. Then comes the fir of the Carpathians and Transylvania, which can hold its own on the European market. As for beech wood for carpentry, its exportation, especially to Italy and Spain, is progressively increasing. The chief external trade is with Austria, whence we import large quantities of deal. In 1912 the total amount imported by Hungary was 660 800 tons, worth £ 1 334 000, while 1 060 700 tons, worth £ 3 463 000, were exported.

Cattle breeding being practised on a large scale in Hungary, the question of pasturage has often caused difficulties, especially on account of the preventive measures adopted in favour of forestry. The question has been solved, thanks to the elaboration and application of the system of grazing forests, according to which the requirements of stock-breeding can be satisfied as far as the state of the forest and its soil permit. At present, most of the forests are already free from servitude and the work of dividing the properties is, to a great extent, completed.

The State forests. — In Hungary, the largest owner of forests is the Treasury. Its forest enterprise, which has long been carried out in a systematic manner, is one of the largest of the State undertakings, and is a considerable factor in its financial resources. Also from the points of view of public and economic interest, the State forests play an important part in the forestry of the country.

Table III gives the area of the State properties in the forest regions according to the branches of cultivation.

The total value of the properties amounted to £9 024 in 1912. The distribution of the various trees in the State forests is given for 1912 in Table IV.

With the exception of some forests of oak and of softwood broad-leaved trees in the south of the country and in Slavonia which are in the plains, the State forests clothe the mountain districts, especially in the highest zones. Above these occur alpine pastures in many districts, and the greater part of the sterile ground is also found here in the rocky regions above the limits of vegetation. The alpine pastures and the meadows are let to

TABLE III. — *Areas of the Hungarian State properties in the forest regions (acres).*

	Built-over property	Arable land	Meadows,	Pasturage	Alpine pastures	Waste land	Total of unwooded area	Forests	Total area
Hungary proper . . .	6 052	20 575	68 446	60 123	164 899	53 088	373 182	2 809 801	3 182 983
Croatia-Slavonia . .	111	3 526	2 950	34 514	1 216	18 202	60 521	820 516	881 037
Totals . . .	6 163	24 101	71 396	94 637	166 115	71 290	433 703	3 630 317	4 064 020

TABLE IV. — *Area occupied by the principal trees in the State forests of Hungary in 1912 (acres).*

	Unexploited forests	Regularly exploited forests.					
		Oak		Conifers	Birch and other hardwood broad-leaved trees	Willow, poplar and other soft-wood broad-leaved trees	Total of regularly exploited forests
		high forest	coppice				
Hungary proper. . .	306 980	265 655	4 599	912 867	1 289 657	30 042	2 502 821
Croatia-Slavonia . .	78 128	118 956	—	90 162	531 296	1 974	742 388
Totals . . .	385 108	384 611	4 599	1 003 029	1 820 953	32 016	3 245 209

the inhabitants of the respective districts. Of the alpine pastures belonging to the Treasury, about one-half are found in Maramaros county, where are established model dairies and cheese factories, which are being imitated in other districts of Hungary. In the mountainous regions, fish-breeding is also practised, trout being the most important fish. Pasturage, letting of meadows, fisheries, shooting, the temporary agricultural exploitation of clearings, brick-making and lime burning yield at present, as secondary resources of the forests, an annual revenue which may be estimated at £ 75 000, while the primary resources, which include charcoal and the production of wood for firing, carpentry and building, as well as of sawn wood (beams, props and staves) bring in an annual revenue of £ 1 000 000.

According to the budget of 1912, the expenditure on the State forests was £ 752 000 and the receipts were £ 1 033 000, which gives a balance to the good of £ 258 000, or a profit of 1s 5d per acre. In previous years, when circumstances were more favourable, the budget showed profits of from £ 290 000 to £ 375 000.

Before giving an opinion upon the results obtained in our time, it is necessary to take into consideration the fact, that it is not yet possible to practise in Hungary the intensive exploitation of forests which obtains in

Western countries ; on the other hand, we must not forget that wages, the great cost of transport, patronage charges and loans given free or at a low interest, are also a heavy burden upon the State enterprise.

The timber is sold by public auction, either as it stands or in dépôts as sawn timber. As wood for carpentry and builder's timber is also sold retail, not only the large merchants, but also small traders, are able to purchase it. The retail sale is effected according to prices fixed in the tariff for forest products.

For transport, more than 6000 miles of large and small forest roads, 1250 miles of waterway and 168 miles of railway are available. Much importance is now attached to the last means of transport, on account of the great distances and the large quantity of timber of enormous dimensions to be transported. The expense of the organization of means of transport, building and the purchase of real property must be estimated at £ 62 500 per annum.

The cost of the reafforestation effected in 1912 on the State properties is set forth in Table V.

TABLE V. — *Reafforestation effected in 1912 on the State Properties.*

	Reafforestation by means of			Total cost	Average cost per acre of reafforestation by means of			
	natural regeneration	sowing	planting		sowing		planting	
	acres	acres	acres		s	d	s	d
Hungary proper . .	4 352	1 337	24 489	31 517	9	1	25	8
Croatia-Slavonia . .	—	536	299	834	12	11	32	7
Total . .	4 352	1 873	24 788	32 351	—	—	—	—

In Hungary, the Treasury nurseries (857 acres) have furnished for:

reafforestation of the State forests. . . 38 243 000 trees
 private persons 1 609 000 »
 the promotion of silkworm breeding . . 4 892 000 young mulberry trees.

Of the trees supplied, $\frac{5}{6}$ were pines and $\frac{1}{6}$ oaks and other broad-leaved trees.

In Croatia-Slavonia, the State nurseries (11 $\frac{1}{2}$ acres) yielded 701 000 young trees for the use of the State forests.

The Staff of the State forests consists of : 501 foresters, 87 accountants, 8 clerks, 9 doctors, 22 assistant foresters, 1391 forest rangers, 266 foremen. The number of permanent woodsmen is 2300, while other workmen number about 22 000.

Organisation of the Forest Administration. — The direction of all forestry matters devolves upon the Hungarian Ministry of Agriculture, which for the accomplishment of this task has created and incorporated

two large forestry sections, of which one carries out the work relating to Hungary proper : viz. 1) forest inspection and administration ; 2) arrangements regarding forest exploitation ; 3) administration of the forest register ; 4) experimental service ; 5) forest statistics ; 6) control of the Staff ; 7) technical instruction ; 8) the reafforestation of denuded land. The other section superintends all the economic and administrative business relating to the State forests situated in Hungary and Croatia-Slavonia, as well as all matters regarding the workmen, the proprietors and patronage.

In order to ensure the general supervision of all the forests, the country is divided into 20 districts, at the head of each of which is placed a royal forest inspector with the necessary assistants under him. In each county has been instituted a commission of forest police, to which the forest inspector is attached in the capacity of consulting member. Matters regarding infractions of forest regulations are dealt with by the administrative organs.

Compossessoral, communal and some other forests are administered by a forest direction with 43 forest offices, to which are subordinate 167 forestry agencies which extend their services to 91 counties and municipal boroughs. The forests of the city of Fiume are directly under the Ministry. In the Government administration are employed 294 superior and 100 subordinate functionaries, who supervise the reafforestation work. The proprietors are responsible for the maintenance of the foresters. The State forests in Hungary are administered by four forest directions, four chief forest offices and seven other forest offices ; in Croatia-Slavonia, they are administered by a forest direction, one chief forest office and one other forest office.

In conclusion we will give some information respecting instruction in forestry, the Service of forestry experiments and the part played by the National Forestry Society.

Forestry Instruction. — In 1770, the Empress Maria-Theresa founded at Selmeczbánya the Royal Academy of Mines, to which was annexed in 1807 a chair of forestry and from which there afterwards developed the Royal College of Mines and Forests. It trains foresters, for whom the course extends over 4 years ; only students possessing matriculation diplomas are admitted. After passing the leaving-examination, students must also pass a State examination in forestry preceded by two consecutive years of practical work.

During the scholastic year 1911-1912, the number of lecturers was 14, while the students numbered 405.

Lower grade forestry instruction is given in the four Royal Forest Rangers' Schools, founded by the State between 1883 and 1893 at Királyhalom, Vadászerdő, Liptóújvár and Görgényszentimre. The course lasts two years and the students are boarded. These schools give both theoretical and practical instruction. One of them has a normal supplementary course extending to the third year. The syllabus of the latter is so arranged as to allow of the students being employed in the administra-

tion of small private forest estates. The teaching Staff of these four schools was in 1912 : 4 directors, 4 masters, 4 assistant masters and 18 forest rangers. During the scholastic year 1911-1912, the number of students was 157. These four schools have administered : 9881 acres of forests, 116 acres of nurseries and 119 acres of botanical gardens.

Those persons who have received practical forestry instruction for three years, and have passed the examination for forest rangers may be regarded as fully competent from the technical point of view.

In Croatia-Slavonia, in 1898, a College of Forestry with a four years' course was attached to the University of Zagreb. The teaching Staff consisted of 6 special forestry lecturers, and 23 University professors and Government functionaries. The number of students in 1912 was 64. In Croatia, there is in addition a private school for forest rangers.

Service of Forestry Experiments. — In 1898, there was added to the College of Forestry a Central Station for Forestry Experiments, while four other such stations affiliated to the central one were attached to each of the Schools for Forest Rangers. These stations show great activity in all matters relating to planting, growth, conditions of cultivation, systems of management, etc. The results obtained from these experiments are published in the periodical entitled *Erdészeti Kísérletek* (Forestry Experiments).

The *National Forestry Society*, which has its seat in Budapest, was founded in 1863. It possesses 2087 members (of whom 867 are original members and 1220 ordinary members). It has a library and has published for the last 53 years a bi-monthly periodical - *Erdészeti Lapok* (Forestry leaflets). Further, it makes a grant to the professional journal *Erdő* (The Forest) intended for subordinate forest officials. At the end of 1913, it had a capital of £.42 072. Its aim is to increase the spread of useful information concerning forestry, and to guarantee the interests of forest agents and assist their widows and orphans.

There are in addition : three *Provincial Forestry Societies*, the *Forestry and Hunting Society*, and the *Society of Subordinate Forest Officials*.

In 1877, the *Forestry Society of Croatia-Slavonia* was founded at Zagreb ; it now has 1405 members. This society publishes the forestry journal *Sumarski List* (Journal of Forestry) and as a supplement to the latter, *Lugarški Vijestnik* (Foresters' Communications). At the end of 1913, its capital amounted to £ 7856.

Report on the Poultry Industry in South Australia

by

D. F. LAURIE,

Poultry Expert & Lecturer.

From the earliest days of the founding of this State, poultry keeping has formed a by no means inconsiderable branch of rural industries. It was soon found that the equable climate and general conditions were most

favourable to all breeds and varieties of domestic poultry. Various importations of different breeds were made from time to time until in due course the newest breeds and varieties evolved in other countries were soon represented here. The fancier was primarily responsible for the introduction of the various breeds, and very soon poultry societies and shows were organised. At the present time there is one Metropolitan Society, in addition to which the Royal Agricultural and Horticultural Society does much to encourage the poultry fanciers, and provides numerous classes at its Shows. In the country districts are numerous poultry societies, and also Agricultural Societies which provide classes for poultry at their annual shows. Specialist clubs attend more particularly to the welfare of several of the prominent breeds.

The poultry fanciers as a rule are not large breeders, and few breed more than two hundred chickens in a year. Farmers throughout the State keep flocks varying in numbers from one to five hundred. The utility breeders, collectively, are becoming an important factor in this State, and many of them breed from one to five thousand or more chickens in a season. At the present time there is a general move in the direction of larger plants, and several are in operation which will shortly provide for several thousand layers and the production annually of many thousands of chickens. Egg production is receiving more attention than flesh production, as the general opinion is that the former is the more certain, and also the more profitable branch.

Among the utility breeders for egg production the White Leghorn (Australian type) is the most popular. There are a few who breed Minorcas, Brown Leghorns, and laying strains of Orpingtons, Langshans and Wyandottes. The all round breeds such as Orpingtons and Wyandottes, Langshans, and Plymouth Rocks are bred in fair numbers and there is every evidence that there will shortly be a great revival in these, or at any rate some of them.

Imports. — No poultry or eggs for human consumption are imported into this State. Poultry breeders import on the average about a thousand head of various breeds from the other States, and oversea, for breeding purposes. They also obtain from the other States annually a few hundred dozens of eggs for hatching.

Exports. — Shipments of eggs in cold storage have been successfully sent to England. Each year some thousands of chickens and ducklings have also been shipped to England where they realised excellent prices. At the present time the great prosperity and rapidly increasing population of the Australian States result in excellent markets for all our available surplus. Increased prosperity and large demand have resulted in very materially improved prices, so that the prospects of the oversea trade, as at present, are not so enticing as they were. The annual value of eggs and poultry sent to the other Australian States is over £ 150 000, and the annual value of the poultry products of this State is £ 750 000. While the growth of the industry has been satisfactory as regards quantity, the increased value is largely due to the higher prices obtained for the products.

TABLE I. — *Result*

		No. of Hens.	Eggs Laid.	Average per Hen.
1st Test, held at Magill	1903-04	156	20 630	132
2nd " " Roseworthy	1904-05	186	21 701	117
3rd " " " "	1905-06	186	31 962	171
4th " " " "	1907-08	450	80 959	179.9
5th " " " "	1908-09	336	63 818	190
6th " " " "	1909-10	678	126 133	186
7th " " " "	1910-11	534	102 723	192.3
8th " " " "	1911-12	756	133 093	176.04
9th " " " "	1912-13	804	146 329	182

Large numbers of high class stock are sent to the adjoining States, New Zealand, South Africa, America, India, and other parts.

Prospects of the industry. — There is no branch of rural activity which can offer to the producers of this State a more satisfactory prospect, as regards markets. Not only are the interstate markets satisfactory and likely to continue, but in addition the general shortage in the World's supplies of eggs and table poultry affords markets in England and on the Continent, which will be available for profitable exploitation in the near future.

Government Assistance. — Seventeen years ago the Government of the day was struck by the possibilities of the industry. An experienced breeder and expert was appointed to lecture in the country districts and to write pamphlets and articles and to take steps to promote the breeding of poultry on commercial lines. Grants of money were made to various poultry and agricultural societies to provide prizes to encourage the breeding of certain specified breeds of poultry.

Exhibits of an instructive nature were organised, and staged at the metropolitan and the chief country agricultural shows. These exhibits demonstrated the best methods of packing eggs and poultry for market. Principal foods, with their uses and feeding values, were shown, together with a mass of valuable information in statistical form easily understood. In connection with the export trade to England the State made cash advances on both eggs and poultry shipped, in addition to undertaking the grading, packing and shipping of eggs, and the killing, preparation, grading and packing of table poultry, also the sale in England.

The Poultry Section of the Department of Agriculture is organised as follows:

The Poultry Expert & Lecturer is officer-in-charge, assisted by two Inspectors. Correspondence, which includes a large amount of instruction, the designing of poultry plants for breeders, investigation of

of the series of Tests.

Eggs Laid by Winning Pen.	Market Value	Cost of Food per Hen.	Return per Hen.	Profit per Hen.	Average Price of Eggs per Doz.
	£ s. d.	s. d.	s. d.	s. d.	d.
1032	77 7 8	7 9	9 11	2 2	10.8
1251	58 7 4	3 1	6 3 $\frac{1}{4}$	3 2	7.74
1343	98 10 11	4 11	10 7	5 8	8.8
1531	273 0 0	5 4 $\frac{1}{2}$	11 10	6 5 $\frac{1}{2}$	9.8
1447	232 19 10	5 9 $\frac{3}{4}$	13 10	8 0 $\frac{1}{4}$	11.09
1531	470 12 5	5 6 $\frac{1}{2}$	13 10	8 3 $\frac{1}{2}$	11.54
1513	358 17 8.9	5 10 $\frac{1}{2}$	13 5	7 6 $\frac{1}{2}$	11.2
1589	545 6 2.7	4 11 $\frac{1}{2}$	14 4 $\frac{3}{4}$	9 5 $\frac{1}{4}$	11.8
1413	663 11 2	5 7.8	16 6	10 10.2	13.06

diseases, the inspection of poultry yards under the Stock Diseases Act, are carried out from the Adelaide Office.

The Expert lectures at various country centres in connection with local Agricultural Bureaux and Agricultural and other societies. He also lectures at the Agricultural College, Roseworthy, and gives annual courses at the School of Mines & Industries. Personal visits of inspection and to impart advice on the spot are paid by the Expert and Inspectors. Beginners are supplied with plans of buildings, the erection of which is supervised; and, if required, all operations are overlooked.

Publications. — Through the Departmental Journal of Agriculture breeders are supplied each month with information contained in seasonable notes, general and special articles. Much time is given to original research on diseases and parasites and the results are published in the Journal and in Bulletin form. A "Poultry Manual" (now in the third edition) is on sale at a nominal price. All other publications, including an extensive Annual Report and Bulletin on the Egg Laying Competitions, are distributed gratis.

Poultry Experiment Station. — Until recently there were three Poultry Stations, one at Roseworthy, on the Agricultural College grounds, one at Murray Bridge, and one at Kybybolite, in the south east part of the State.

It was deemed desirable, for many reasons, to concentrate all work at one centre and a new site was chosen at Parafield, near Salisbury. Parafield was formerly a wheat-breeding station and consists of 100 acres of first-class wheat land, but rather heavy for poultry. The distance from Adelaide is only 11 miles by rail and about 10 miles by road. Here will be assembled, with many additions, the dismantled poultry stations removed from the old sites. The accommodation now in course of provision will include a block of 160 pens for the Laying Competition, yards and

houses to accommodate 5000 laying hens, and 150 pens of breeding stock with chicken-rearing yards to accommodate 10 000 to 12 000 chickens. There are two incubator rooms fitted with Cypher's hot-air machines of 400 egg capacity. Two brooder houses each 100 ft. long are provided, and the brooders and incubators are heated by an air gas (gasoline) plant, which will save labour and obviate many disabilities. Food stores, and distributing houses, workshops, stables, etc., are also in course of erection. Water is laid on to all buildings and pens. The whole of the land will be under cultivation, and considerable areas of lucerne and other fodder crops will be grown under irrigation.

In addition to the Laying Competition it is intended to organise Single Testing Competitions. Each competitor will enter 6 pullets, each of which will be confined in a small house and run: this is a more accurate and scientific method than trap nesting. Food tests will be carried out, and many problems connected with incubation, breeding, etc. will be dealt with. It is intended to accommodate sufficient laying hens to provide sufficient revenue to make the Station self supporting.

The education value of this easily accessible Poultry Station will be very great.

Later on provision will be made for students and also for the delivery of short lectures to the public on visiting days. The present staff consists of seven assistants, Assistant Superintendent, Superintendent and two farm hands. In addition to the 930 competition birds there are 50 pens of breeding stock and about 2000 layers. The breeds are White Leghorns and American Barred Plymouth Rocks. Later on some other breeds will be stocked.

The Laying Competition. — The results of the South Australian State controlled Laying Competitions have attracted attention throughout the world. The object of these tests is to demonstrate that it pays to breed good strains of layers and also to house and feed them properly. These three important considerations are not always understood, nor is their true value recognised.

Table I (pp. 1402-1403) shows the results of the Competitions hitherto held.

The current test 1913-14 consists of 154 pens, the largest number ever gathered in one test.

There are three sections: Sec. 1. Light Breeds; Sec. 2. Heavy Breeds; Sec. 3. Pens entered by Farmers, Pastoralists, Fruit and Vegetable growers.

The egg production in the first three months is satisfactory and there is every prospect that the final result will uphold the great reputation of the fowls of this State.

EXPERIMENTAL AND RESEARCH WORK.

Feeding poultry for egg production. — During recent years continuous feeding tests have been carried out at the Poultry Stations in connection with the Egg Laying Competitions, which are organised by the Department of Agriculture.

TABLE II. — *Feeding Test from June 1st, 1910, to May 31st, 1911 (12 Months).*
10 White Leghorn Pullets in each Test.

Pen.	How Fed.	June	July	August	September	October	November	December	January	February	March	April	May	Total
1	Morning. — Mash, ground rye, wheat, bran, meat meal Midday. — Green feed Evening. — Rye, grain in litter Morning. — Mash, oat flour, wheat, bran, meat meal	89	63	94	82	187	151	105	129	50	152	66	16	1 184
2	Midday. — Green feed Evening. — Oats in litter Night & Morning. — Mixed grain Midday. — Green feed	101	116	104	107	133	153	107	178	71	172	70	5	1 317
3	Morning. — Grain Midday. — Green feed Night. — Competition mash Morning. — Green feed	82	104	147	130	169	123	93	128	63	101	10	4	1 154
4	Midday. — Green feed Night. — Competition mash Morning. — Green feed Midday. — Green feed	93	108	128	99	161	122	112	163	102	108	25	4	1 225
5	Morning. — Half competition mash, half grain Midday. — Green feed Evening. — Same as morning Dry competition mash continuously in hopper	62	83	139	91	160	112	93	150	44	108	55	11	1 108
6	Midday. — Green feed Evening. — Grain in litter Morning. — Competition mash Midday. — Green feed	45	62	69	53	125	77	90	98	61	71	78	24	853
7	Evening. — Grain in litter Morning. — Competition mash Midday. — Green feed Evening. — Grain in litter	44	32	74	67	158	180	133	125	70	122	67	19	1 091
8	Morning. — Competition mash with double meat Midday. — Green feed Evening. — Grain in litter	60	43	94	97	145	187	157	144	76	124	58	11	1 196
	Total	576	611	849	726	1 238	1 105	890	1 115	537	958	429	94	9 128

TABLE III.

Breed	Total Number Eggs Laid for March.	Total Number Eggs Laid for Year.	Average per Pen.	Average per Hen.	Number of Deaths.
Black Orpington	140	3 495	699	116.5	7
Silver Wyandotte	392	4 930	986	164.3	3
White Leghorn	273	5 515	1 103	183.8	2

TABLE IV. — *Egg production of various breeds.*

Number of Pens	Number of Birds	Breeds.	Total	Average per Pen	Average per Hen
65	390	White Leghorn	77 523	1 192.67	198.7
19	114	Black Orpington.	20 045	1 055.2	175.8
4	24	Buff Orpington	3 940	985.2	164.2
2	12	White Orpington	1 582	791	131.8
5	30	Silver Wyandotte	5 500	1 100	183.2
4	24	White Wyandotte	3 777	944.25	157.3
3	18	S. C. Brown Leghorn	3 012	1 004	167.3
2	12	R. C. Brown Leghorn	1 987	993.5	165.5
2	12	Minorca	1 915	957.5	159.5
2	12	Langshan	2 106	1 053	175.5
1	6	Black Leghorn	964	964	160.6
1	6	Buff Leghorn	738	738	123
1	6	Ancona	1 000	1 000	166.6
1	6	Andalusian	961	961	160.1
1	6	Plymouth Rock	1 069	1 069	178.1

Throughout the series the feeding has been only slightly varied and is as follows:

7 a. m. — Mash, a mixture made as follows: bran 1 part by weight, is scalded over night generally with soup made from meat meal; this is mixed with pollard two parts, and worked to a crumbly mass. Sometimes lucerne hay chaff, in the proportion of about one third of the bulk, is used. At noon a supply of cut green food is fed, and in the evening a meal of grain, which is generally wheat. In cold weather maize, oats, and peas are fed occasionally.

It may be added that the birds are confined in yards 10 feet wide, by

TABLE V. — *Fertility Test* (Male bird removed Dec. 12).

Date Eggs Laid		Eggs set.	Fertile	Infertile.	Per Cent.
1911					
December	12th	10	10	—	100
"	13th	10	10	—	100
"	14th	10	10	—	100
"	15th	10	9	1	90
"	16th	10	10	—	100
"	17th	9	7	2	77
"	18th	10	9	1	90
"	19th	10	9	1	90
"	20th	10	8	2	80
"	21st	10	7	3	70
"	22nd	6	3	3	50
"	23rd	7	3	4	42
"	24th	6	3	3	50
"	25th	10	2	8	20
"	26th	7	—	7	—
"	27th	10	2	8	20
"	28th	10	1	9	10
"	29th	10	—	10	—
"	30th	10	—	10	—
"	31st	9	—	9	—
1912					
January	1st	10	—	10	—
"	2nd	10	—	10	—
"	3rd	10	—	10	—
"	4th	10	—	10	—

40 feet long, with a house at one end. The yard is floored with scratching litter.

Testing various foods. — To test various foods and methods of feeding, 80 carefully selected White Leghorn pullets were divided into flocks of 10 each, housed and yarded under similar conditions.

Table II (p. 1405) shows the results.

Breed tests. — A further test extending over 12 months was made. In this test 30 carefully selected pullets of each of three breeds were taken. The results are shown in Table III.

In the various detailed reports of the Egg Laying Competitions the results of the egg production of each breed represented have been tabulated.

TABLE VI. — *Weights and Measurements of Eggs and Shells.*

No	Breed	Weight gms.	Length, Long Diameter cm.	Breadth, Short Diameter cm.	Thickness of Shell				Weight of Shell gms.	Weight of Shell as percentage of egg	Color and Appearance of Shell
					Large End	Small End	Middle	Average			
			cm.	cm.	mm.	mm.	mm.	mm.	mm.		
1	Black Orpington	66.95	6.16	4.43	0.371	0.423	0.413	0.402	0.423	8.53	Brown, good, large
2	Black Orpington	52.15	5.41	4.13	0.512	0.431	0.394	0.445	6.21	11.90	Tinted, good, medium
3	Buff Orpington.	62.75	5.91	4.26	0.561	0.441	0.501	0.501	7.38	11.60	Brown, good, large
4	Buff Orpington.	51.65	5.63	4.11	0.392	0.472	0.421	0.428	6.39	12.37	Brown, good, medium
5	White Orpington.	60.87	5.89	4.21	0.399	0.423	0.422	0.414	7.18	11.79	Brown, good, medium
6	Plymouth Rock ..	71.85	6.09	4.59	0.451	0.432	0.549	0.477	8.08	11.24	Brown, good, large
7	Plymouth Rock.	58.25	5.52	5.29	0.442	0.473	0.448	0.454	7.68	13.18	Brown (dark), large
8	Silver Wyandotte.	62.86	5.78	4.37	0.439	0.489	0.458	0.462	7.15	11.37	Tinted brown, large
9	Silver Wyandotte.	47.15	5.21	3.98	0.472	0.451	0.423	0.448	6.18	13.10	Tinted brown, small
10	Langshan	61.55	5.77	4.32	0.423	0.381	0.458	0.420	6.54	10.62	Brown, large
11	Langshan	58.41	5.62	4.29	0.451	0.481	0.379	0.437	6.93	11.86	Brown, medium
12	White Leghorn.	75.65	6.18	4.71	0.466	0.451	0.442	0.453	8.63	11.40	White, large
13	White Leghorn.	57.37	6.11	4.18	0.399	0.393	0.392	0.394	6.29	10.96	White, medium
14	Black Minorca . .	73.16	6.05	4.67	0.445	0.448	0.549	0.480	8.92	12.19	White, large
15	Black Minorca . .	68.75	6.02	4.45	0.431	0.573	0.511	0.505	8.14	11.84	White, large
	Average	61.95	5.82	4.39	0.443	0.450	0.450	0.448	7.34	11.87	

Table IV (p. 1406) is representative of this and concerns a number of different breeds and varieties.

Fertility test. — At the close of the breeding season a test was carried out to ascertain how long after the removal of the male bird from the breeding pens the eggs laid would be fertile. The result is shown in Table V (p. 1407).

These Tests were confirmed on other occasions.

Weights and measurements of eggs of various Breeds of Fowls. — A dozen average eggs of fifteen different breeds and varieties of fowls were selected and carefully measured and weighed. Table VI shows the results.

Loss of weight in eggs during incubation. — Numerous experiments have been made. Careful records have been tabulated of the temperatures and moisture content of the air of the incubator rooms and of the incubators. Hot-water heated and hot-air heated machines were used. The average loss of weight per egg was found to be: hot-air machines, 16.24 per cent; hot-water machines, 15.78 per cent.

Flesh production. — Among other tests certain pure breeds and crosses were selected and fed with a cramming machine. The results are as follows:

Breed	Average increase per bird.	
Indian Game crossed S. Wyandotte	2 lbs.	1 oz.
Buff Orpington.	1	5 ½ "
White Wyandotte crossed O. E. Game.	1	5 "
Indian Game crossed Dorking	1	2 "
Black Orpington.	1	2 "
White Leghorn		14 ½ "
Faverolles		15 ½ "

Investigating diseases of poultry. — Most diseases of poultry are due to the presence of ecto and endo parasites. The following are met with and have at various times been the subject of investigation.

Parasite.	Disease caused
<i>Argas persicus</i>	Spirochaetosis
<i>Goniodes</i> sp.	Phthiriasis.
<i>Gonitocotes</i>	Are probably carriers of spirochaete and other endoparasites.
<i>Menopon</i>	
<i>Lipeurus</i>	
<i>Dermanissus gallinae</i>	
<i>Coccidium avium</i> (<i>gallinae</i>)	Coccidiosis in fowls and turkeys. Little Chick Cholera.
<i>Nematoda</i> (<i>Heterakis</i> sp.)	Malnutrition, arrested metabolism and septicaemia.
<i>Taeniae</i>	Taeniasis.
<i>Demodex</i>	Itch, etc.
<i>Sarcoptes</i>	Scaly leg.
<i>Lophophyton</i>	Lophophytosis (Favus).

Various diseases, such as roup (generally due to invasions of *Bacillus diphtheriac gallinae*) and chicken pox (due to a fungoid parasite), are commonly met with and have been carefully studied. Preventive measures in all cases are advised as the only scientific method as regards successful poultry culture. Bulletins on some of the above parasites have been published and others will appear in due course.

**Work of the Entomological Section
of the Swedish Central Agricultural Experiment Station,
during the Years 1907-14.**

by

Prof. ALBERT TULLGREN,

Director of the Section.

The Entomological Section has had from the beginning a twofold aim. On the one hand it gives the public advice and information on all questions connected with agriculture and kindred industries, and on the other hand it works at the theoretical and practical solution of certain problems of economic importance, such as the life history of animal pests and the means of controlling them.

This latter field of activity should naturally be the most important for the Section, as the scientific and practical solution of the problem connected with animal pests forms the necessary basis for really useful advisory work; nevertheless the actual state of things is quite different, owing to several obstacles which have hitherto been unsurmountable. During the period 1907-14 the Section has, in the first place, accomplished a vast amount of informatory work. The public has availed itself of this privilege in a large measure; the Section endeavours at the same time to keep in close touch with farmers by means of correspondence and the diffusion of articles drawn up in a popular form. There is no doubt that these efforts have been attended by much success, as is proved by the fact, among others, that the control of the commonest animal pests — at least in the domain of horticulture — has become, of late years, more general and more intense.

One of the factors of the informatory work of the Section — a factor which also favours to a great extent practical and scientific research, — is the service started in 1911 which has taken the name of Intelligence Service. Its chief object is to supply a certain, and if possible, complete knowledge of the distribution, frequency and life-history of injurious animals in Sweden, as well as the value of the means of control, etc.

There are in different parts of the country about 500 persons ready, according to their culture and available time, to transmit at certain periods reports on the animal pests of their districts. These reports include not

only the animals which injure field crops, but also those which cause damage to gardens, orchards, and forests. All these reporters have the advantage of being entitled to send their correspondence and samples post free.

The Intelligence Service has, as has been said above, two advantages. On the one hand it facilitates the relations between the Section and the public, and on the other it supplies the Section with considerable material for study. By means of the correspondence and research work on the samples sent in, the Section endeavours to determine, as far as possible, the exactness of the communications received. The reporter who has taken part in this work for some years and has become interested in it acquires a relatively good knowledge concerning the commonest animal pests and may in his turn supply information. The Section has already learned a good deal from the reports that it has received. Thus, for instance, the knowledge on the distribution and life-history of *Argyresthia conjugella* Zell. and of *Aphis padi* L. has been enriched by precious contributions.

As regards the scientific activity of the Section, it may be stated that it has illustrated, in its principal publications, the life-history of many injurious animals of importance to Sweden. One of the insects most injurious to fruit trees in the country, the above-mentioned *A. conjugella*, has especially been the object of diligent study. The results of these investigations have been published in the "Communications" of the Central Institute. For several years past the aphides of Sweden have been studied with the greatest care. The first part of a monograph on them was published in 1909. Of late years the life-history of several Tenthredinids has been likewise studied. To these works must be added researches on Acari, wood-boring Lepidoptera, and Coleoptera (such as the larvae of Elateridae and of Halticinae) of importance from an economic point of view. Some of the results obtained have also been published in our "Communications".

As for the practical and experimental work, the following deserves special mention. A vast series of investigations has been carried out in the matter of the utility of carbolineum in horticulture. The result of these investigations has been that spring spraying with 8 to 10 per cent emulsions has been proved to be extraordinarily efficient against several animal pests, such as apple sucker (*Psylla mali* L.), pear-leaf blister mite (*Eriophyes piri* Pagst.) and numerous scale-insects. On the other hand it has been ascertained that against fungi the utility of carbolineum is very limited, and that in certain cases it may prove fatal to plants.

Numerous experiments have also been made with lime-sulphur washes, partly to check results obtained abroad and partly to increase our knowledge regarding this important means of control.

Among arsenical compounds used in sprays, only Paris green and arsenate of lead were experimented on a large scale. Good results against the animal pests of Cruciferae have been obtained by adding to the wash substances capable of increasing its adhesiveness, such as gelatine.

Besides the above-mentioned sprays, the Section submitted to critical examination a great number of other products, including two English preparations for the disinfection of the soil: "Vaporite" and "Apterite". But all these investigations yielded almost exclusively negative results.

Among the injurious animals — which of late years have attracted special attention — the following deserve to be mentioned: winter moth (*Cheimatobia brumata* L.), codling moth (*Carpocapsa pomonella* L.), *Argyresthia conjugella* Zell., apple sucker (*Psylla mali* L.), pear-leaf blister mite (*Eriophyes piri* Pagst.), *Agriotes* sp., *Phyllotreta* sp., *Haltica* sp., *Phaedon cochleariae* Fabr., *Hyponomeuta* sp., *Coleophora laricella* Hbn., *Tetranychus* sp., *Bryobia praetiosa* C. L. Koch.

The efforts of the Section to improve its material position also form a part of its work. Its desires have been to a great extent realized of late years. In 1913 a new building for the Institute was erected; it is spacious and arranged in the most modern manner to meet the requirements of practical and scientific experiments. A remarkable collection of preparations illustrating the cycle of development and the habits of our animal enemies, an important collection of photographs, and a rich library may also be considered as, to a great extent, the result of our activity during recent years.

SECOND PART. ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION.

975 - **Encouragement of Olive Growing and Fruit Growing in Tripolitania.** — *Decreto del Governatore*. Tripoli, August 6, 1914.

On the suggestion of the Director of the "Ufficio Agrario" of Tripoli, all growers shall be entitled to a grant of 4 *d* for each properly grown young olive plant obtained from seed or from cuttings and 2½ *d* for every almond or other fruit tree grafted. The "Ufficio Agrario" is authorised to distribute a suitable number of olive plants ("ovoli" or cuttings) and grafted fruit trees to growers who apply for them and give the assurance that they will undertake to cultivate them according to the recognized agricultural practice.

LEGISLATIVE
AND ADMINI-
STRATIVE
MEASURES

976 - **Agriculture in Réunion.** — *Ministère des Colonies Bulletin de l'Office colonial*, Year 7, No. 78, pp. 300-309. Melun, June 1914.

The island of Réunion has an area of 970 sq. miles. It is essentially volcanic and is divided into two groups of mountains joined on the south-west by the Plaine des Cafres and on the north-east by the Plaine des Palmistes.

Réunion is an essentially agricultural country; plants from all parts of the tropics flourish in the littoral zone and those from temperate regions in the mountainous interior. All the land is available to cultivation except the forest reserves established in 1874, which comprise nearly 400 sq. miles. The remaining portion is distributed as follows:

DEVELOPMENT
OF
AGRICULTURE
IN DIFFERENT
COUNTRIES

	q _ illes
Coast zone suitable for cultivation	390
Cultivable area in the cirques and islets	75
Area unsuitable for cultivation	115

Soils. — The soils consist of volcanic matter in different degrees of disintegration, the process being most advanced in those of the north-west mountain group, where also the deepest sediments occur. They are characterised by a low percentage of lime and potash, probably due to leaching.

Climate. — Two types of climate prevail: one in the east, extending from St. Joseph to St. André with a rainfall of 2300 mm. (90 inches), and the other with a rainfall of scarcely 900 mm. (36 inches). There are two distinct seasons: the cool season from May to October with a minimum mean monthly temperature of 21.15° C. (July); the warm season from October to April with a maximum mean monthly temperature of 27.5° C. (February). The only danger to crops is from cyclones which often lower the yield by 20 to 40 per cent.

Agricultural Position in 1892 and 1912.

Area cultivated	In 1892	In 1912
	acres	acres
Sugarcane	72 000	47 000
Vanilla	1 680	1 380
Coffee	3 830	2 970
Cacao	62	86
Cloves (isolated trees)	area undetermined	
Tobacco	865	1 240
Manioc	3 880	8 650
Aromatic plants	740	4 000
Maize	37 000	50 000
Fallow, bare or cropped	50 000	37 000
Various crops, potatoes, orchards, vegetables, gardens	15 000	12 500
<i>Exports.</i>		
Sugar tons	37 800	37 960
Vanilla lbs.	212 235	148 051
Coffee "	426 191	30 515
Cacao "	1 883	1 378
Cloves "	2 930	309
Tobacco "	83 319	247 846
Essential oils "	23 732	103 593
Rum gallons	370 026	774 772
Tapioca and starch, tons	654	2 037
Dried manioc "	—	242
Choco (<i>Sechium edule</i>) lbs.	—	108 097
Spirits from sugar cane gallons	—	51 328
<i>Fourcroya gigantea</i> fibre tons	—	202
Preserved fruits lbs.	—	21 475

The total value of the exports of the chief agricultural products may be estimated at £578 000 in 1892 and £645 000 in 1912; it should be noted that in the latter year the price of sugar was very low: 9s 8d to 10s 6d per cwt.

Price of land. — The average value per acre varies from £16 to £64 according to the locality, and it has not appreciably varied during the last 20 years.

Sugarcane. — This crop covers about a quarter of the cultivated area. From 1870 to 1912 the annual production varied between 20 000 and 38 000 tons, reaching a maximum of 46 000 tons in 1895. Some richer varieties have recently been introduced and propagated, *viz.*: Bigtanna, 33, Boabilla, Cristalline, No. 100, etc. Under good cultivation they yield 18 to 19 per cent. of sugar. Chemical manures are in common use, resulting in bigger yields being obtained. The factories provided with 6-cylinder mills and defibrators obtain from 1500 to 1550 lbs. of juice per ton of cane.

Vanilla. — The average yield from 1892 to 1912 was about 70 tons, reaching a maximum of 200 tons in 1898. The crop gives excellent results in the island, but has suffered considerably from recent cyclones.

Coffee. — The yield of coffee has fluctuated considerably between 1892 and 1912. The exports have fallen from 426 190 lbs. in 1892 to 23 755 lbs. in 1900 and 30 515 lbs. in 1912. This is coincident with a fresh outbreak of *Hemileia* in 1900, which was successfully treated with copper sprays, but in 1902 occurred an outbreak of *Lecanium viride*, introduced from Mauritius and Ceylon. New species have been introduced, but the planters prefer the old types, *arabica* or round coffee and *roy* or pointed coffee.

Aromatic plants. — The cultivation of these plants has increased considerably during the last 20 years. In 1892, 23 732 lbs. of essence of geranium and ylang-ylang, valued at £20 000, were exported. The exports in 1912 were as follows :

	lbs.
Essence of geranium	95 105
» » vetiver.	3 132
» » ylang-ylang	4 718
» » patchouli	110
» » citronella	489
» » longose	40

representing a total value of £90 730. Geranium is extensively cultivated. Ylang-ylang has taken a more important place with the rise in price of this essence, which reached nearly £10 per lb.; important plantations were established in the littoral zone and continue to exist to-day in spite of the fall in price. Other plant essences, such as patchouli, citronella, lemon-grass, gardenia and "longose", are distilled with success.

Manioc. — This crop has increased greatly since 1892, when there were only three mills dealing with about 12 million lbs. of manioc. At the present time there are seven mills producing about 4 ½ million lbs. of flour and tapioca from about 40 million lbs. of tubers. During recent years dried manioc has been exported in small cakes containing 85 to 90 per cent. of flour. This product is used in France in the preparation of alcohol for liqueurs.

Textile plants. — The crop from these is not very profitable. *Fourcroya gigantea*, or Mauritius hemp, yields only 35 to 40 per cent. of fibre. Sisal hemp (*Agave Sisalana*) yields a greater percentage of fibre fetching a higher price. An experiment in jute cultivation at the Botanic Garden was successful and the cultivation of this crop should be very important in the island, since more than half a million sacks are used annually in the sugar and manioc industries.

New crops. — Several new crops have been introduced during the past 20 years, the most important being the following: varieties of manioc rich in starch; sugarcane from Mauritius, Hawaii, Barbados, Australia; disease-resistant coffees, including *C. robusta*, *C. stenophylla*, *C. congensis*, *C. canephora*, and the varieties Maragogipe and Golden Drop, as well as some Javanese hybrids; new varieties of exotic tobacco, of which Maryland, White Burley, Connecticut and Szamoshati have given excellent results as cigar leaf; new selected varieties of aromatic plants, andropogon, citronella, lemon-grass, patchouli, longose, gardenia, ylang-ylang, peppermint. New varieties of sisal hemp have been planted on a large scale. Since 1911 *Canna edulis* has been cultivated on the high plateaux; it yields a flour highly prized by biscuit makers. Of new forest plants the following have been introduced: the carob, Java kapok, various tannin-yielding acacias, *Styrax benzoin*, etc.

New industries. — Preparation of perfumes by volatile solvents; new factories for the distillation of flowers with modern fractional distillation apparatus; a ground-nut-oil factory. The apparatus in the sugar factories has been greatly improved. A hydro-electric motor has been installed for supplying electric power to the port from the Galets stream.

The *Agricultural Service* was founded in 1854 with the institution of a Botanic Garden for the multiplication and preservation of useful plants in the colony. In 1907 a School of Agriculture was founded at Providence and in 1911 an experiment station followed. A scheme of reform for the experiment station and reorganization of the Agricultural Service has been presented to the General Assembly.

The Colonial Section of the Botanic Garden of Palermo, which has existed since 1907, has now acquired autonomous administration with the functions of State Colonial Garden. In its new form, this institute will study and experiment with exotic plants useful in industry and commerce, with a view to the agricultural and economic development of the colonies, and to the increase of agricultural production at home by means of new crops.

CROPS AND CULTIVATION.

- 978 - **The Effect of Climatic Conditions on the Rate of Growth of Date Palms.** — VINSON, A. E., in *The Botanical Gazette*, Vol. LVII, No. 4, pp. 324-327 + 2 diagr. Chicago, April 1914.

AGRICULTURAL
METEOROLOGY

The observations on which this study of the effect of climate on the rate of growth of date palms is based were made at the Cooperative Date Orchard, Tempe, Arizona. The length of every leaf on four palms — two Deglet Noors and two Rhars — was carefully measured every week during 1906 and 1907. By the system adopted the maximum error did not exceed one-quarter inch. Daily records were also kept of maximum and minimum atmospheric temperatures, and of soil temperatures at 1, 3 and 5 ft. below the surface. It was observed that after a new leaf has emerged well from the central bud, it makes the greater part of its growth in five or six weeks. In order to obtain a series of comparable figures representing weekly growth it was found that the sum of the elongation of the inner five leaves gave the most satisfactory series.

Both years the rate of growth was maintained late into the autumn, considerably in excess of the amount of heat available.

The rate of growth is most active not at the period of highest maximum, but rather at that of the highest minimum temperatures, which means warm nights. This period coincides with the summer period of highest relative humidity, that is, in Arizona, in July, August and sometimes September, and it is at this time that weakly palms recover their vitality. By far the greater part of the total yearly growth falls in the second half of the year. The rate of growth throughout the entire year is, in most cases, in proportion to the heat-time units over 50° F. (10° C.). Humidity is undoubtedly an important factor, but probably less so to date palms than to other plants.

The rate of maturation of the fruit is probably influenced by the same factors as the rate of growth of the foliage. The effect of high minimum temperature in promoting the ripening of the Deglet Noor date has recently been observed at Gafsa, in Southern Tunis.

- 979 - **The Influence of Sulphur on Soil Acidity.** — LINT, H. CLAY (New Jersey Agricultural Experiment Station, New Brunswick) in *The Journal of Industrial and Engineering Chemistry*, Vol. 6, No. 9, pp. 747-748. Easton, Pa., September 1914.

SOIL PHYSICS,
CHEMISTRY
AND
MICROBIOLOGY

Considering the favourable results obtained by the application of flowers of sulphur to the soil for the control of some parasitic fungi which are capable of persisting in the soil (for instance *Oospora scabies*, which causes potato scab), the question of its effect on the acidity of the soil acquires a certain importance.

The researches of DEMOLON (1), BRIOUX and GUERBET have not only proved that the sulphur in the soil is converted into sulphates by bac-

terial action, but they have furnished data on the influence of various substances such as calcium carbonate, saccharose, peptone, etc., when added to the soil in which the sulphur was introduced.

In the writer's recent work under field conditions, as much as 600 lbs. of sulphur was applied per acre; it was noticed that a large amount of the sulphur was still present at digging time apparently in an unchanged condition. In order to ascertain facts on the rate of oxidation of the sulphur in the soil a series of tumblers containing 100-gram portions of soil were arranged, one-half containing sulphur, the other half without it; 33 mgms. of sulphur, equivalent to 1000 lbs. per acre-foot (3 000 000 lbs.) were added. The soils were made up to 20 per cent. moisture content and covered with Petri dishes. The moisture content was kept practically constant throughout the experiment, which lasted 11 weeks. One tumbler containing soil mixed with sulphur and one without were removed each week and tested for acidity.

It appeared that the sulphur had almost all been oxidized within the first eight or nine weeks. There is very little change in the acidity after the seventh week.

The fact that sulphur causes this increase in acidity under field conditions is shown by the following table, in which are the analyses of soils from four old potato rows to which sulphur had been applied the preceding year; the fifth row had not received any sulphur.

In valuing the results it must be borne in mind that rows 1 and 2 had received ammonium sulphate, while rows 3 and 4 had had sodium nitrate.

Row —	Rate of sulphur application, lbs. per acre	Lime requirement, in lbs. CaO per acre
1	600	3 187
2	300	2 590
3	600	3 025
4	300	2 247
5	none (check)	883

Laboratory experiments show that sulphur oxidizes more rapidly in sandy than in clay loams, and in those kept constantly at 20 per cent. of moisture than in those allowed to dry from time to time.

980 - **Acid Mineral Soils.** — DAIKUHARA, S., in *The Bulletin of the Imperial Central Agricultural Experiment Station, Japan* (article in German), Vol. II, No. 1, pp. 1-40 + 1 table. Nishigara, Tokio, March 1914 (1).

The acid reaction of certain soils is generally due to the presence of humic acids; other causes are the oxidation of pyrites particles, repeated application of certain fertilisers, such as sulphates of ammonia and potash on soils poor in lime, volcanic emanations or the initial fermentation of organic manures, such as green crops, cakes, straw, fresh dung. There is another instance of acidity in purely mineral soils which has not yet been

(1) See also preliminary note, abstract No. 600, *B.* July 1914.

(Ed.).

described. It is produced by the adsorption of compounds of iron and alumina by colloids of the soil, which then give an acid reaction to litmus. In soils of this type free from humic acids, the acidity persists after leaching, since it is insoluble ; but treatment with a solution of neutral salts, such as potassium chloride, potassium sulphate, potassium nitrate, sodium chloride, results in the appearance in solution of free acid with the compounds of iron and alumina. Since the salts of iron and alumina are adsorbed by the humic acids and other colloids of the soil and are set free again on treatment with neutral salt solutions, these compounds must exercise considerable influence not only on the acidity of purely mineral soils, but also on that of soils containing humus.

The injurious action on vegetation of compounds of alumina and iron adsorbed by the soil colloids is due chiefly to the liberation of soluble acid salts of iron and alumina on the application of saline manures.

In Japan and Korea a large number of soils, making about three-quarters of the samples examined, show an acid reaction, due in more than half the cases to compounds of alumina and iron. Soils of Mesozoic origin have most often an acid reaction ; they are followed by the Tertiary, Palaeozoic and Pleistocene, whilst alluvial soils show acidity only half as often as the Mesozoic. Further, soils formed from so-called acid crystalline rocks show acidity in a larger number of cases than those from basic rocks, while those formed from volcanic ashes still less frequently show acidity.

Litmus paper is the simplest means of determining qualitatively the acidity of a soil. More exact methods are those of Baumann and Gully and of Loew. The writer proposes an equally exact and simpler method using potassium nitrite. It consists of treating 5 gms. of soil in a test-tube with a 10 per cent. solution of pure potassium nitrite, adding it drop by drop until the soil becomes thoroughly moist ; the test-tube is then closed with a plug of cotton-wool, from which hangs a strip of starch-iodide paper ; after a certain time the degree of acidity of the soil can be determined by the intensity of the blue coloration of the paper.

The property of liberating free acid from neutral salts possessed by the colloidal compounds of iron and alumina has suggested to the writer a method of determining quantitatively the acidity of soils by means of potassium chloride. For this 100 gms. of air-dried soil are treated with 250 cc. of normal potassium chloride solution in a retort of 600 cc. capacity during 5 days, shaking it at intervals, or better placing it in a shaking machine for one hour ; 125 cc. of the supernatant liquid are then taken and boiled until free from carbon dioxide, when it is titrated with a decinormal solution of caustic soda, using phenolphthalein as indicator. A further 125 cc. of the potassium chloride solution is added and the titration repeated. This process is repeated until all the acidity has been determined. By determining the relation of the first titration to the total quantity of acid the method can be reduced to one operation ; the writer is preparing a formula for this. Tables are also given showing the quantity of limestone or quicklime necessary to neutralize a given quantity of soil.

The above-mentioned acid soils are generally deficient in lime, the ratio of lime to magnesia being unfavourable to growth. These observations are summarized in the accompanying table.

Reaction of the soil and the ratio $\frac{\text{lime}}{\text{magnesia}}$

Reaction of Soil	Mineral acidity of Soil — cc. of $\frac{\text{N}}{10}$ NaOH	Cultivated Soils		Uncultivated Soils	
		No. of samples	Mean ratio $\frac{\text{lime}}{\text{magnesia}}$	No. of Samples	Mean ratio $\frac{\text{lime}}{\text{magnesia}}$
Extremely acid	> 20	8	0.81	15	0.54
Very acid	20—5			20	0.65
Acid	5—1	13	0.88	11	0.96
Feb'y acid	< 1	12	1.33	29	1.04

PERMANENT
IMPROVEMENTS,
DRAINAGE
AND
IRRIGATION

981 — Irrigation in Spain. — DE LA ROSA, FERNANDEZ, in *Boletín de Agricultura técnica y económica, Dirección general de Agricultura, Minas y Montes*, Year VI, No 67, pp. 620-622. Madrid, July 31, 1914.

Except for the north-west of the Iberian peninsula where the rainfall is abundant and regular, almost the whole of Spain suffers from frequent drought or irregular rainfall. The problem of irrigation therefore presents itself and has been dealt with since the remotest times. Proof of this is found in the remains of hydraulic works of aboriginal tribes and of the Roman period, also in the irrigation canals constructed by the Arabs for watering the orchards of Valencia and Murcia and the rich plains which extend from the mountain slopes in the districts of Malaga and Grenada and the regions bordering the Ebro. Later constructions are the grand canals of Urgel in Catalonia and Imperiale in Aragon, but it was only at the end of last century that they were utilized to the full.

Three systems of irrigation are practised in Spain: 1) by means of *wells* from which the water is raised by wheels or more rarely mechanical pumps; 2) *canals* fed by the large rivers by means of hydraulic wheels or dykes; 3) *artificial lakes* ("pantanos") which feed the irrigation canals. Preference has been given to the collection of water in reservoirs, in place of the direct deviation of rivers, owing to the fact that during the winter rains they become devastating torrents, whilst during the summer the water is considerably reduced and many rivers dry up. The total irrigated area is estimated at 3 233 108 acres, of which about 200 000 acres are irrigated with subsoil water. This area is distributed in the four great districts of Spain as follows:

Aragon and Navarre: The canals Imperiale, Tauste, Jalón, Gallego, Huerva, and artificial lakes of San Bartolomé, and of Mezalocha in the province of Saragossa; canal of Jaca, reservoirs of Huesca and Híjar, ir-

gation canals from the Guadalaviar, the Jiloca and the Martín in the provinces of Teruel and Huesca; artificial lakes of Grágera, Calahorra, and Cervera in the province of Logroño, and canals of the Río Llano and Bayuriga in the province of Pamplona. The total irrigated area is 580 091 acres.

Catalonia: The canal of Urgel in the province of Lerida; canals of Manresa, the Infanta and others fed by the Llobregat in the province of Barcelona; numerous branches from the Ebro in the province of Tarragona and the small reservoirs of Puigcerdá, Figueras, La Bisbal and Santa Coloma de Farnés in the province of Gerona; in all about 472 920 acres irrigated.

Levante: Irrigation canal Real del Júcar de la Mayor and numerous others from the Turia and Palancia in the province of Valencia; canals of Mijares, which fertilise the "Plana" in the province of Castellón; artificial lakes of Tibi, Elche and Elda in the province of Alicante; irrigation canals by filtration from the Segura, Guadalentín and Moratella, and artificial lakes of Puentes and the Val de Infierno in the province of Murcia: total 629 259 acres.

Boetic-Mediterranean region: The rivers Genil, Guadix, Dauró, Illora and Guadalfeo in the province of Grenada; canals of Guadiaro and Genal, artificial lakes of San Pedro Alcántara and San Luis de Sabinillas, and the wells of Marbella in the province of Málaga; numerous streams or small canals ("caceras") from different watercourses in the province of Almería; in all 364 690 acres under irrigation.

The above sixteen provinces comprise about two-thirds of the irrigated area in Spain; the other thirty-three provinces make up the remaining third.

Since 1900, the Government has initiated hydraulic works on a large scale and organised a special Department consisting of 10 divisions, for carrying out the numerous projects. The following works have been completed: artificial lakes at Mesalva (Teruel), Gragera (Logroño), Peña (Huesca), Gasset (Ciudad Real), Talava and Alphonso XIII (Albacete) and the Aragón and Catalonia canal.

The following are in course of construction: the artificial lakes of Cueva Foradada and Pena (Teruel), Toix (Barcelona), Riudecanyes (Tarragona), Guadalmellato (Córdoba) and Guadalcañin (Cádiz). Amongst the numerous projects in course of discussion, the most important concern the artificial lake of the Ebro, the artificial lake of Cuerda del Pozo in Duero, and the irrigation of the lower valley of the Guadalquivir, in the provinces of Córdoba and Seville. On the completion of these works during the next ten years, unless unexpected developments arise, over a million acres of land will be brought under irrigation. Nevertheless, the total area suitable for irrigation is at least 10 million acres, and it will require many generations before the irrigation requirements in this country are completed.

Artesian wells have been tried in some provinces for several years, but with only meagre results. Though satisfactory in certain parts of Levante, they were a complete failure in other parts of the southern region. The boring of these wells in the province of León was successful, especially on the Royal estate of El Pardo.

MANURES
AND
MANURING

982 - Experiments with Bacterized Peat. — *The Agricultural News*, Vol. XIII, No. 321, p. 263. Barbados, August 15, 1914.

Experiments have been made with a view to determining under English conditions the practical value of Professor BOTTOMLEY'S (1) bacterized peat.

One series was conducted in the open ground and the other on plants in pots and boxes. During the former a drought occurred which rendered it difficult to draw any conclusion as to the beneficial effect produced by bacterized peat.

But when artificial watering was adopted in order to compensate for the lack of rain, the favourable results were always evident. In one experiment with lettuces and radishes grown in ordinary garden soil and manured with different substances which included guano and bacterized peat, the results showed these two substances to be of about equal value.

But the most interesting series of trials and the one which seemed to show conclusively that bacterized peat is of value, was that in which radishes (96 per box) were grown in ordinary soil in boxes 1 yard square and treated as indicated in the following table:

	Roots		Tops		Total Weight	
	lb.	oz.	lb.	oz.	lb.	oz.
Control, two boxes, average	0	11	0	8 ½	1	3 ½
Farmyard manure, small dressing	0	12	0	12	1	8
Guano (½ oz. before sowing, and ½ oz. top dressing)	0	14	0	8 ½	1	6 ½
A well proved fertilizer, ½ oz. before sowing and ½ oz. top dressing	1	0	0	11	1	11
Nitrolin (3 oz. per box before sowing)	1	3	0	12	1	15
Bacterized peat (4 oz.)	1	8 ½	0	13 ½	2	6
Bacterized peat (8 oz.)	1	5	0	11	2	0

The result shows: 1) that bacterized peat is of high manurial value; 2) that it favours the development of both roots and tops (leaves) but especially the former; 3) that, as has been observed in other experiments, a lighter dressing of bacterized peat is somewhat more effective than a heavier one. Incidentally the experiment goes to show that nitrolin is a fertilizer which deserves a good trial on garden crops.

Bacterized peat used in the relatively small quantities in which it can be used effectively does not appear to exercise a beneficent action on the water-holding capacity of the soil; it has valuable manurial properties and these do not seem to be limited to the provision of nitrogen.

These experiments confirm the results reached by the earlier experiments at Kew and elsewhere.

(1) See No. 410, B. May 1914.

983 — **The New Potash Deposits in Spain.** — 1. Documentos parlamentarios, Criaderos de sales potásicas y otro minerales empleados como abonos ó que sirven para su fabricación. — *Boletín de Agricultura Técnica y Económica*, Year VI, No 68, pp. 739-743. Madrid, August 31, 1914. — 2. Editorials, Potash Supply. — *The Engineering and Mining Journal*, Vol. 98, No. 11, p. 497. New York, September 12, 1914. — 3. SCHMIDT, K. Die Kalilager in Katalonien. — *Zentralblatt für die Kunstdünger- Industrie*, Year XIX, No. 16, pp. 338-339. Mannheim, August 15, 1914.

1. — Following the announcement of the discovery of deposits of potash salts in Spain, the Minister of "Fomento" has presented a scheme for the regulation of their exploitation.

According to this report, the deposits in the neighbourhood of Suria and Cardona (prov. of Barcelona) give hope of considerable future development, as much by the area, depth and strength of the beds as by the quality of the minerals. Various companies have explored these deposits and have applied for concessions several thousands of acres in area, not only in the province of Barcelona but also in those of Girona, Lérida and Huesca.

The Spanish Government, realizing the importance of the question, nominated a commission of the Geological Institute of Spain to undertake the necessary researches. This commission has issued a memoir confirming the favourable prospects of the discovery. Considering that the consumption of potash salts in Spain has reached the value of £149 270 (3 731 750 pesetas) and that it will increase considerably when the price is reduced, the Spanish Government considered it advisable to submit to Parliament measures concerning the exploitation of these discoveries, for the benefit of agriculture and national prosperity.

The first article of the law reads as follows :

" From the date of publication of this law all mining concessions for potash salts and other minerals employed as manures or for the fabrication of manures, including all minerals containing or capable of producing such substances, even though the concessions may have been granted under another denomination, are placed under state control with regard to the production and sale of the products obtained. The concessionaries must undertake to continue the prospecting and working of the concessions without interruption.

" The State reserves the right to regulate and change the manner of working in the interests of the public and to impose special conditions in the interests of the national consumption, such as the imposition of a tariff on exported products "

2. — In confirmation of the above it is useful to note that amongst the most important of the concessionaries is an American firm, the " American Agricultural Chemical Co. ", which has undertaken the working of some of these deposits. The last report of this company gave promise for the future and stated that the deposits resembled those in Germany.

3. — In this connection may be considered the communication of Professor Schmidt before the last meeting of the German Geological Society at Berlin and the discussion which followed.

The deposits of potash salts are found in the Tertiary strata of the Ebro basin, *i. e.* in the same region as the large mass of rock salt at Cardona

known since antiquity. The discovery was made by a small contractor who came across layers of carnallite and sylvine whilst boring in the neighbourhood of Cardona. Prospecting made up to the present shows that there is a deposit 260 ft. in thickness, containing 70 ft. of beds of carnallite with 20 per cent. potassium chloride, and 33 ft. of sylvine with 95 per cent. potassium chloride. Later explorations will establish the extent of these deposits. In origin they are analogous to those of Alsace, *i. e.* they are not primary formations resulting from the evaporation of seawater, but secondary formations derived from more ancient saline deposits, probably from Triassic saline deposits of the Pyrenees and the coast ranges of Catalonia.

984 - **Manuring Experiments with Manganese Carbonate in Italy.** (1) — D'IPPOLITO, G., in *L'Agricoltura moderna*, Year XX, No. 17, pp. 259-260. Milan, September 1-15, 1914.

Experiments with manganese carbonate were conducted on wheat and three-year-old lucerne. The latter crop, which had received a dressing of superphosphate and sulphate of potash at the end of the winter, was divided into two plots: one of 1370 sq. yds., manured on the 18th of March with 50.7 lbs. of natural manganese carbonate of 35 per cent. purity; and the other of 1292 sq. yds. with 48.5 lbs. of phospho-manganese (a natural rock containing 35 per cent. carbonate and 11 per cent. phosphoric acid). These amounts are equivalent to 180 lbs. per acre for each plot. A third plot of 1091 sq. yds. was used as a control.

The quantities of hay obtained in the first cut are as follows:

Plots	Yield of hay per acre
	cwt.
1 with phospho-manganese	61.9
2 " manganese alone	61.5
3 control	40.6

The succeeding cuts were damaged by rain and are omitted. The net profits of the manured plots over the unmanured were £1 8s 10d and £1 7s 11d per acre respectively.

The wheat was grown on broken-up lucerne ley manured with 535 lbs. per acre of basic slag. Two plots, each of 594 sq. yds., were chosen; 33 lbs. of natural manganese carbonate was applied to one and 35 lbs. of phospho-manganese to the other, making 267 lbs. per acre. A third plot of 566 sq. yds. was used as control. The variety Hybrid Unlodgeable was sown at the rate of 107 lbs. per acre.

The results at harvest were as follows:

Plots	Yield of grain
	bu. p. acre
1 with phospho-manganese	48.3
2 " manganese alone	41.1
3 control	31.3

(1) See also Nos. 226 and 266, *B.* March 1913.

(Ed.)

The net profit of the manured over the unmanured plots was £3 11s 5d with phospho-manganose and £1 12s 9d with manganose.

These results show the importance of manganese to crops. The writer also remarks that no other of his 11 experimental plots, not even that with nitrate of soda, reached the yield of these manganese plots.

985 - **Comparative Morphology of Some Leguminosae.** — MARTIN, JOHN N., in *The Botanical Gazette*, Vol. LVIII, No. 2, pp. 156-167 + IV plates. Chicago, August 1914.

The writer carried out at the University of Chicago and at the Iowa State College microscopical investigations which enabled him to determine the process of development of the embryo-sac, embryo and endosperm of *Trifolium pratense*, *T. hybridum*, *T. repens*, *Medicago sativa* and *Vicia americana*.

In the course of his investigations the writers observed that the sterility of ovules is a prominent feature in *Trifolium pratense*, and this seems to be due to moisture conditions. Undoubtedly this tendency always lowers the percentage of seed production and in some cases reduces it almost to zero. The fact that this tendency varies among plants under similar conditions suggests that it may be partly eliminated by selection. The tendency toward sterility is not so pronounced in *T. hybridum* and is not much marked in *T. repens*. No sterility was observed in *Medicago sativa*, but all material used, so far, was collected during rather dry periods, and further investigation is necessary to determine the effect of moisture upon its fertility. In *Vicia americana* some sterile ovules were found, but the tendency toward sterility is not so pronounced as in the clovers. The literature cited includes fourteen works.

986 - **The Exchanges between the Plant and its Nutritive Solution.** — MAZÉ, P., in *Comptes rendus hebdomadaires des Séances de l'Académie des Sciences*, Vol. 159, No. 3, pp. 271-274. Paris, July 20, 1914.

In experiments on maize the writer has shown that the production of a given weight of vegetable tissue requires a constant volume of mineral solution of definite composition and concentration. He has further shown that the roots excrete mineral and organic matter (1). The present researches provide an experimental basis for studies on the function of osmosis in the absorption of nutritive substances by roots.

Maize plants were grown in aseptic mineral solutions containing 2 to 5 per cent. of saccharose. At the moment when the plants lost their turgescence in the sunshine owing to the increased concentration of sugar, the percentage of sugar was determined in the nutritive solution and in the sap of roots, stem and leaves. The results obtained showed that the nutritive solutions contained more sugar at the end of the experiment than at the beginning and that there is no relation between the sugar composition of the nutritive solution and that of the saps of the various parts of the plant. The exchanges between the plant and its nutritive solution are therefore in this case not subject solely to the laws of osmosis, but are rather sub-

(1) See No. 19, B. Jan. 1914.

(Ed.).

ject to the chemical work of the plant. In order to reduce the respiratory functions to a minimum, the plants were placed for 11 days in a position facing north with diffused light of low intensity. In this case also analysis showed that the nutritive solution contained more sugar at the end of the experiment than at the beginning and that the plant had consumed some of its reserve sugar. The exchange between the root and the nutritive solution is not therefore in accordance with the laws of osmosis.

In a medium containing excess of one or several ingredients, the roots become impervious even to water. Considering that in the case of physiological nutritive solutions colloidal organic bodies are absorbed, it follows that the function of absorption of the roots is one of filtration, the speed of which is determined by the chemical activity of the plant at any given moment.

987 - The Influence of the Osmotic Pressure of the Soil Solution on the Growth of Spring Wheat. — TOULAIKOFF, N. (Director of the Experiment Station of Bésaintchouk, Russia), in *La Pédoologie*, Year XV, No. 4, pp. 71-103. Petrograd, 1913.

Analyses of the nitrogen content of wheat grains in south-eastern Russia show a slight increase in the nitrogen content of wheat from slightly saline soils. This fact had already been noticed by V. S. BOGDAN in his work on the wheats of the district of Novouzensk.

The higher protein content of wheat from south-east Russia was formerly attributed to the low rainfall. This explanation is plausible, if the low rainfall accounts for the increased concentration of the soil solution. The writer was therefore led to study the physical, as distinct from the physiological, effects of salts on the wheat plant, as in the earliest stage of development the germinating grain is subject more to the physical than to the chemical changes of its environment. As the swelling and germination of the grain depend chiefly upon the rapidity of absorption of the surrounding solution, it seemed advisable to begin by studying the influence of the osmotic pressure of salts on growth.

Experiments were made with the salts occurring in the region of Bésaintchouk, viz. NaCl, Na₂SO₄, etc. They were carried out during 1910-13 in zinc vases containing about 11 lbs. of black soil (chernoziom) seeded with the spring wheat Biélotourka. The necessary nutritive solution was supplied in order to obtain the maximum yield of vegetable matter. In the calculation of the osmotic pressure in the soil solution, the nutritive matter already present in the soil and that added is omitted, as it would not be possible to determine it by ordinary methods. However, since the same quantity of soil and manure was added to each pot, the osmotic pressure of the soil solution may be considered the same in each case (about 4 atmospheres) and left out of account. Therefore in speaking of 3, 5, 7 or 10 atmospheres of osmotic pressure, the figures refer to the increases of osmotic pressure due to the non-nutritive salts added. The control pots containing no non-nutritive salts were maintained at a constant osmotic pressure of about 4 atmospheres by maintaining a constant humidity of 60 per cent. of the maximum by means of daily spraying with distilled water. Both nutritive and non-nutritive salts were added to the pots

at the time of filling. The osmotic pressure of the solutions of non-nutritive salts was determined for the pure salts, and not their mixtures.

Experiments in 1910 and 1911. — These were only of a preliminary nature, to determine the suitable limits of osmotic pressure.

Experiments in 1912. — The following salts were used: sodium chloride, sodium sulphate, magnesium sulphate, sodium carbonate and ammonium nitrate. The first three were also used in mixtures of two and three. Ammonium nitrate was not used as a nutritive salt, but only to increase the osmotic pressure. The osmotic pressures compared were 0, 5, 7, 12 and 15 atmospheres.

Twelve sprouted grains of wheat were planted in each pot on the 13th of April. On the 18th, the control pots and those with a pressure of 5 atmospheres showed seedlings 5cm. high. The seedlings in pots of higher pressures were much shorter, but not so much in the case of ammonium nitrate. The plants in the control pot commenced tillering on the 24th of April, whilst the others did not begin before the 28th and 29th. They were thinned out on the 2nd of May, leaving only seven plants in each pot. The height of the plants was measured on the 15th and 29th of May and the 7th of June. It was found that during the first period of vegetation small quantities of salts stimulate the vegetative growth of wheat, but that later they retard it: towards the 3rd of June the control plants were higher than all the others.

Increase of osmotic pressure causes an appreciable diminution in the mean growth of the variety Biélotourka, though it hastens the appearance of the ear, the flowering and the ripening, thus shortening the vegetative period. Exception to this occurred in the ammonium nitrate pots, in which the phases were retarded and the vegetative period was longer even than in the controls.

As the plants reached maturity they were submitted to the following tests: length of ear, yield of total vegetable matter and of grain, weight of 1000 grains, percentage of nitrogen in grain, coefficient of transpiration (calculated). The data obtained showed that increase of osmotic pressure diminishes the yield of total vegetable matter and grain, the length of ear and the weight of 1000 grains, whilst it increases the percentage of nitrogen in the grain even in soils rich in nitrogenous matter.

Experiments in 1913. — The maximum osmotic pressure was reduced from 15 to 12 atmospheres and for every salt experimented with two additional pots with an osmotic pressure of 3 atmospheres were added. Since the experiments of 1912 had shown that the salts of the soil solution cannot be considered as merely increasing the osmotic pressure, but as exercising also other influences, physical, physiological, etc., it was considered advisable to increase the number of salts under experiment. The following salts were therefore used: sodium chloride, ammonium chloride, calcium chloride, magnesium chloride, sodium sulphate, ammonium sulphate, magnesium sulphate, sodium nitrate, ammonium nitrate.

The results obtained are summarised in the Table below, which shows clearly the existence of a stimulating action of all salts when the osmotic

pressure reaches 3 atmospheres. At this pressure, under 1913 conditions the coefficient of transpiration of Biélotourka was lowered, while the total yield and the yield of grain were increased, although the weight of 1000 grains was decreased by 1.1 gm. from that of the controls.

Mean results of 1913 experiments.

Osmotic pressure of soil solution	Water evaporated, gms.	Coeff. of transpiration	Total yields, gms.	Yield of grain, gms.	Weight of 1000 grains, gms.	Nitrogen content of grain, %
Normal	15 622	314.2	48.2	18.71	38.27	2.068
» + 3 atmospheres	16 156	(minimum) 391.5	(maximum) 55.44	(maximum) 23.43	37.14	2.283
» + 5 »	11 503	307.2	38.37	15.16	33.70	2.931
» + 7 »	9 207	362.5	29.72	10.15	24.04	3.564
» + 10 »	5 998	418.9	17.48	4.46	23.13	3.885
» + 12 »	3 494	630.7	7.30	2.72	22.47	—

An increase of osmotic pressure above 3 atmospheres caused a decrease in the yield of grain and in the 1000-grain weight, as well as a less efficient utilisation of the soil moisture, assuming that the coefficient of evaporation increases proportionally to the increase in osmotic pressure. On the other hand an increase of osmotic pressure caused an increase in the percentage of nitrogen in the grain and in the flintiness, but a decrease in the percentage of starch.

Action of different salts and their elements.

A. *Acids.* — 1) At an osmotic pressure of 3 atmospheres the maxima of total yield and yield of grain are obtained from nitrates, which are followed by sulphates and then by chlorides.

2) At 5 atmospheres the highest yields are given by the sulphates, followed by chlorides with respect to grain and nitrates for still less grain.

3) At 7 atmospheres, the yield is better with sulphates than with nitrates.

B. *Bases.* — At 3 and 5 atmospheres ammonium salts give the largest increase of total yield and of grain yield, as well as the largest percentage of nitrogen in the grain. In respect to yield the salts of magnesium come second and those of sodium third. In respect to percentage of nitrogen, sodium salts come second and magnesium salts third.

Conclusions. — 1) The character of the soil solution, especially its concentration and osmotic pressure, have a distinct influence on the vital functions of spring wheat. Increase of osmotic pressure at first stimulates growth, then beyond an optimum limit of 3 atmospheres, whatever the salt, it has a depressing influence on growth, but at the same time increases the percentage of nitrogenous matter in the grain.

2) Under certain meteorological conditions, a very pronounced stimulating action on the wheat plant can be obtained by bringing the osmotic pres-

sure up to the optimum, irrespective of the salt used. This results in a greater yield of straw and grain, a better quality of grain, a higher nitrogen content and a more efficient utilisation of the soil moisture by the plant.

3) The presence of nitrogen in solution, either as base or acid, appreciably increases the yield of straw and grain as well as the percentage of nitrogen in the grain, compared with non-nitrogenous salts. Of the latter, sulphates have a greater influence on yield than chlorides.

988 - The Action of Various Electrolytes on the Grains of *Avena sativa*. — PLATE, F., in *Annali di Botanica*, Vol. XII, Part 3, pp. 261-343. Rome, May 1914.

These researches concern the stimulating effect of chemical agents on the imbibition of grains of *Avena sativa*.

It is well known that seeds are able to resist injury from solutions of salts up to a certain concentration and that such solutions exert an influence on the subsequent development of the embryo and seedling. In these experiments the effect of the different ions of acids, bases and salts was investigated. The strengths of the solutions used were

$N, \frac{N}{2}, \frac{N}{5}, \frac{N}{10}$, and the period allowed for absorption was 2 hours. The

increase in weight of the seed was determined at intervals of half an hour. Observations were made of substances which accelerate or retard germination and on the effect of imbibition on the external morphological characters of the seedlings with special reference to the size of the shoot and root, and the fresh and dry weight of the seedling. The quantities of salt absorbed were determined by weighing and also in parallel series of experiments by analysis of the liquid remaining after each period.

From these results the writer concludes that immersion for only two hours exerts an influence in many cases not only on the physico-chemical phenomena of imbibition, but also on the subsequent development of the seedlings. The absorption of distilled water or tapwater varies within near limits according to the individuality of each grain, but generally it increases rapidly during the first stage of immersion, continues more steadily during the second stage and decreases slowly during the third stage until it ceases completely. The beginning of imbibition and the quantity of water absorbed vary with different grains, with different solutions and according to the concentration. These experiments confirm the conclusion that during imbibition, seeds absorb more proportionally of the solvent than of the electrolyte, so that the solution becomes more concentrated after immersion.

Classified according to their effect on imbibition the substances are grouped as follows :

1) Substances not absorbed and having no influence on imbibition : the chlorides of sodium, potassium, calcium, barium and zinc ; bromides of sodium and potassium ; nitrates of potassium, barium, cadmium and silver ; sulphates of potassium, cadmium and copper ; formate, acetate, and oxalate of potassium.

2) Substances absorbed without influencing the total amount of liquid absorbed under normal conditions : the chlorides of cobalt and iron,

3) Substances which, though not absorbed, diminish considerably the imbibition: acid phosphates of sodium and potassium, sulphates of aluminium, chromium and iron.

4) Substances which, though not absorbed by the seeds, not only diminish the imbibition but also influence the germination: ferrocyanide, permanganate and bichromate of potassium; the alums of potassium, chromium and iron; the nitrites of sodium and cobalt; the chlorides of cerium, tin, cadmium and mercury; bromide of mercury.

5) Substances which are absorbed and diminish the imbibition, as well as affecting germination: iodides of cadmium, sodium, potassium, and the nitrates of mercury and cobalt.

6) Substances absorbed, increasing the imbibition and also favouring the germination: formic, acetic, oxalic, nitric, sulphuric and phosphoric acids.

7) Substances not absorbed, but accelerating imbibition and to a considerable extent promoting germination: malic, citric, tartaric and hydrochloric acids.

Excluded from this list are the hydrates of the alkalis and alkaline-earth, which in the concentrations used were fatal to the grains.

It follows from these results that substances which are absorbed for a period of two hours, do not penetrate throughout the seed, but are arrested at the testa. It remains to be determined if they will penetrate further if imbibition is prolonged.

Malic, citric and tartaric acids are most favourable to growth, though they are not absorbed by seeds. This is explained by supposing that some indeterminate trace of acid acts on the seeds catalytically and causes a greater acceleration of the physico-chemical processes.

These researches support the conclusion that the laws of absorption are not constant for all solutions and concentrations, but that specific coefficients of absorption should be attributed to each cation or anion.

The specific actions of hydrogen ions and hydroxyl ions have considerable biological importance, and it is probable that the carboxyl group is not less important.

989 - Effect of High Frequency Currents on Plants. — HOMBERGER, ERNST, in *Die Umschau*, Year XVIII, No. 36, pp. 733-735 + 2 figs. Frankfurt-on-the-Main, September 5, 1914.

The writer recalls the observations of Lemström, who attributed the greater rapidity of growth in polar regions to the higher potential of atmospheric electricity, and the experiments in electroculture carried out by Lemström, Lodge and others. While the use of high tension continuous and alternating currents led directly to the soil and to the plants was always connected with injury to the latter as soon as the intensity of the current exceeded certain limits, this injury was no longer observed when alternating high frequency and high tension currents were employed.

Experiments of this kind were recently conducted in the Moräne farm near Dayton in the United States. Several experimental plots were sown with radishes and salad. After they had sprouted the electric current was started.

One plot was subjected to the action of high frequency currents which passed through a wire stretched at about 16 inches above the soil. The difference of potential between the soil and the conductors was about 10 000 volts; the frequency was of 200 000 periods per second generated by Tesla currents. The passage of the current lasted one hour in the morning and one hour in the afternoon. The growth of the salad compared to that of the check plot was increased by about 75 per cent.

Alternating high frequency currents are biologically harmless to plants, animals and man. Arsonval introduced them into therapeutics. On transforming high tension into high frequency, diathermic currents are obtained with which heat can be produced in the deep strata of animal tissues. With the diathermic apparatus the human body can be traversed without danger by currents of an intensity somewhat over 1 ampère; only if the intensity be too much increased does combustion take place.

The writer experimented upon plants with such an apparatus; he placed the two electrodes in flower-pots with plants between them. Most of the experiments were carried out with beans, and they regularly showed that the stem grew thicker and the leaves larger than in the check plants. During the experiments three treatments per day were made; as soon as the temperature reached 35° C. the current was interrupted. The length of time that the soil retained the heat was remarkable and still more so the fact that the stem and the leaves formed a greater quantity of chlorophyll than those of the check plants.

In order to determine whether the greater intensity of growth was due to the heat or to the high tension of the electromagnetic field, the writer treated other plants of beans with Tesla's currents (that is high tension and high frequency). The effect of one such treatment lasting 5 minutes was very evident and proved that the stimulus to growth is due to the oscillating field and not to heat. The greater formation of chlorophyll in the treated plants is perhaps due to the fact that under the influence of the oscillating electro-magnetic field chemical decompositions take place in which large molecules take part; these decompositions are similar to those caused by the catalytic action of the still more rapid luminous vibrations.

990 - Influence of X-Rays on Vegetation. — MÈGE, EM., and COUPÉ, H., in *Comptes Rendus hebdomadaires des Séances de l'Académie des Sciences*, Vol. 159, No. 4, pp. 338-340. Paris, July 27, 1914.

Experiments were made on *Raphanus sativus* and *Lepidium sativum*. Ten seeds were sown in each of a number of pots of garden soil and covered with half an inch of leaf-mould. The pots were then subjected to the action of the rays; the frequency and the intensity of the radiations varied in the nine groups that were made. Differences began to appear on the 22nd day; the experiment terminated on the 38th day.

From the results of these preliminary experiments the writers conclude:

1. That X-rays exert a clearly favourable action on the vegetation of both *Raphanus* and *Lepidium*, as shown by the increase of weight, which attains in *Raphanus* 45 per cent. for the leaves, 59 per cent. for the whole plant and 193 per cent. for the bulb.

2. — That this benefit is all the more marked the more frequent and intense the radiations, also when they attain an intensity (75 H. per month) which would render them decidedly injurious to animal tissues.

3. That X-rays have a slight reaction on the morphology and anatomical structure of the plants under consideration (in general the vascular and supporting tissues are more developed and better differentiated).

991 — A Study on the Germinating Power of Seeds. — DARSIE, MARVIN L., ELLIOTT, CHARLOTTE, and PEIRCE, GEORGE J., in *The Botanical Gazette*, Vol. LVIII, No. 2, pp. 101-136 + 18 figs. and diagrams. Chicago, August 1914.

Until recently the tests of the longevity or viability of seeds have depended upon the percentages of actual germination in prepared beds. Such tests are simple enough in the case of seeds which germinate quickly and in these cannot be improved upon. When, however, two weeks or more must elapse even under most favourable conditions before one may know the quality, that is the germinating power, of the seeds, a quicker method is desirable, also because in briefer exposure there is less danger of injury or loss from fungus or other enemies. Mr. G. J. Peirce has shown that by using silvered Dewar flasks as calorimeters one may quickly determine that heat is evolved in the germination of seeds and has suggested that there may be such differences in the heats liberated by seeds of different ages that they may be used as indicators of age and germinating power or viability.

Some experiments were undertaken in order to test this idea.

The germination experiments were made in silvered Dewar flasks and in seed beds with seeds of barley, clover, maize (Cory sweet corn), hemp, oats and wheat of different and well known ages. The results show that, other conditions being equal, a high temperature within a reasonable time is indicative of high germinating power, and also of the ability to make a rapid growth of root and shoot after germination, in other words of vigour. With the increase of the age of the seeds the quantity of heat produced diminishes, but of course such decrease is not always perfectly regular, owing to the different climatic conditions under which the seed was grown and harvested, to its degree of maturity and to the conditions of storage. Each species of plant that was studied appears to have, like the higher animals, a "normal" or characteristic temperature, departures from which indicate deviations from the best conditions of the organism. Other conditions being equal the "normal" temperature is evolved by the freshest and most vigorous seed: a higher temperature generally indicates an infection (fungoid); a subnormal temperature on the other hand denotes lessened vigour, generally due to increased age.

The "normal" temperature, or average daily heat yield in terms of 10 grams of seed, is 1.82° C. for hemp, 0.75° C. for clover, 0.73° C. for wheat, 0.55° C. for oats and 0.49° C. for maize.

992 — Selection of Cocksfoot (*Dactylis glomerata*) in New Zealand. — HILL, W. S., in *The Journal of Agriculture*, Vol. VIII, No. 3 pp. 262-265 + 2 figs. Wellington, 1914.

Cocksfoot is one of the most widely distributed and most useful grasses of New Zealand. Its seeds, especially those from the Banks peninsula,

supply a lucrative export trade to Europe. This plant, however, being so widely distributed and growing in the most different environments, presents a number of types and variations. It has been found that the variations in cocksfoot apply not only to the form of the panicle, but also to the quantity, quality, shape and colour of the leafage, to the height, to the degree of rust resistance, to the earliness of maturity, to the yield of seed, etc.

Consequently at the Moumahaki Experiment Farm a work of selection has been started with the aim of producing plants with abundant and good foliage and with a high resistance to rust. Plants exhibiting these desired points to a greater or less extent have been isolated, and the reproduction of selected types is being effected by vegetative or clonal reproduction, by inbred seed and by open fertilized seed.

993 - **Mutation in Egyptian Cotton.** — KEARNEY, THOMAS H. (Physiologist in Charge, Alkali and Drought Resistant Plant Investigations, Bureau of Plant Industries) in *Journal of Agricultural Research*, Vol. II, No. 4, pp. 287-302 + IX plates. Washington, July 1914.

The writer summarises as follows the facts that he has ascertained from the literature on the subject and from the observations made by him during his work of selecting cotton in Arizona.

The origin of the Egyptian type of cotton is obscure. According to one theory, it is a product of hybridization between a brown-linted tree cotton and American Sea Island, both of these types having been cultivated in Egypt nearly a century ago. Whether this be true or not, there can be no question that the varieties now grown are of mixed ancestry, a condition which some investigators regard as favourable to mutation.

Numerous varieties have appeared from time to time in Egypt. The Ashmuni variety, now grown only in Upper Egypt, originated about 1850. This variety gave rise in 1887 to the Mit Affi, and from the latter the Abassi, Yannovitch, Nubari, Sakellaridis and Assil varieties have successively been developed.

As grown in Arizona from imported seed, most of the Egyptian varieties are readily distinguishable by the habit of the plants and by the characters of the leaves, involucre and bolls, as well as by the fibre.

So far as the scanty evidence goes, each of these varieties originated with a mutant, *i. e.* an individual plant which showed an abrupt and definite change in the characters expressed. This conclusion is supported by the more complete data at hand regarding the history of the varieties which have been developed in Arizona.

Plant breeding work in Arizona was begun 12 years ago with imported seed of the Mit Affi variety. Persistent selection of the best plants caused some improvement in earliness and productiveness and in the quality of the fibre, but the progress was not very substantial prior to 1908, in which year two types very different from the Mit Affi were recognized and isolated. One of these was the Yuma variety, now commercially grown in Arizona. This form has continued to express its distinctive characters with a high degree of uniformity, notwithstanding the fact that the parent individual and its immediate progeny were not protected against cross pollination.

Two additional varieties described in this paper under the names "Pima" and "Gila" have lately been developed in Arizona. The Pima variety appeared as a single plant of marked individuality in a field of Yuma cotton at Sacaton, Arizona, in 1910. Its characters have been expressed in its progeny with great uniformity during the three subsequent generations. This variety is easily distinguished from the parent Yuma variety by its relative limbleness and by the correlated retention of the lowest fruiting branches and bolls; by the more uniformly deeply 5-lobed leaves; by the shorter, relatively wider, and nearly separate involucre bracts; by the plumper and more abruptly and sharply pointed bolls and by the longer fibre (average length of fibre: Yuma 1 $\frac{1}{2}$ inch; Pima 1 $\frac{5}{8}$ to 1 $\frac{3}{4}$ in.; Gila 1 $\frac{7}{16}$ in.).

The Gila variety is derived from a single plant discovered by Mr. E. W. Hudson in a field of the Mit Affi stock grown at Sacaton, Arizona, in 1908. In its external characters this type resembles the parent Mit Affi variety much more than the Yuma, but differs in its earlier ripening, smaller vegetative branches, greater productiveness and longer fibre.

The individuality of the parent plant, together with the uniformity shown by its progeny during the subsequent generations, indicates that the Gila variety, like the Yuma and the Pima, is of mutational origin.

Egyptian cotton exhibits, although in a minor degree, the tendency to develop new varieties by mutation which characterizes *Oenothera Lamarckiana*. There is a further parallel in the fact that in both cases very similar, if not identical, new characters come into expression at different times and in different places. An example of this phenomenon in Egyptian cotton is afforded by the Nubari and the Yuma varieties.

If the tendency to produce mutants is a result of remote or complex hybridization, the mutability of Egyptian cotton might be accounted for upon either of the following grounds: 1) the supposed hybrid origin of the type as a whole, or 2) later crossing with other types of cotton.

Ever since mutation became recognized as a factor in the breeding of Egyptian cotton the following methods have been followed in Arizona: 1) recognition and isolation of desirable mutants; 2) selection and comparison on the progeny-row basis of those individuals among their progeny which express most fully the desirable characters of the new type; 3) elimination from the seed increase fields, preferably before blossoming begins, of the aberrant and otherwise undesirable individuals.

The bibliography of the literature cited comprises 21 works.

to farmers if it yields a satisfactory flour; if it fails in this respect it is not included among the list of varieties recommended.

In 1913 two varieties, "Bomen" and "Sunset", were recommended for further trial and they have fully justified that recommendation. Other two varieties, "Canberra" and "Nardoo", are suggested for further trials at the Experiment Farms. The writer describes these four varieties. "Bomen" is awnless and bunt-resistant; in its pedigree it includes an Indian variety "Zaff", one from Manitoba, "Power's Fife" and two Australian wheats. "Sunset" is also awnless; it is intermediate between the medium strong and weak flour classes, and is very early. "Canberra" is slightly awned at the tip; it is a cross between Federation (the dam), and Volga barley, a two-rowed sort; it has yielded well and gives a high percentage of flour which is of excellent colour and belongs to the medium strong class. "Nardoo" is awnless, medium horny; it is decidedly smut-resistant and an excellent hay wheat; it is a hybrid of several varieties, including "White Naples".

Varieties of oats. — Among the oats recommended for further trials at the Experiment Farms by the recent Departmental Conference are "Sunrise" and "Guyra". "Sunrise" is a natural cross bred from Algerian oats, which it surpasses in length of straw by about a foot, and in earliness by a week; it is recommended for the warmer districts. "Guyra" is a cross between "Algerian" and "White Ligovo"; it stools very fairly and its grain is plump; it is suited to typical oat districts.

995 — The Effect of Ammonium Salts on the Tillering of Wheat. — WILD, L. J., in *The Journal of Agriculture*, Vol. IX, No. 1, pp. 31-32. Wellington, N. Z., July 1914.

This experiment was suggested by a statement in Dr. Griffith's "Treatise on Manures", to the effect that treating the seed wheat with a solution of sulphate of ammonia gives an increase in the number of stems produced by the individual plant. Five varieties of wheat were treated with nitrate of ammonia and three with sulphate of ammonia in 3 per cent. solution, and sown in plots of from 10 to 15 square yards in area. Check plots were also sown with untreated seed. No difference was noticed between the treated and untreated plots as regards rate of germination or rate of subsequent growth. When the grain was in ear twenty plants were taken at random from each plot and the average of stalks per plant was determined. The results were as shown in the accompanying table.

These results show that nitrate of ammonia is more effective than the sulphate in increasing the tillering power of wheat and point to the desirability of investigation on a more extensive scale.

Variety	Average tillering power		Increase	Percentage increase
	Treated	Untreated		
<i>Varieties treated with sulphate of ammonia</i>				
Hunter's White	7.5	6.4	1.1	16.7
King's White	6.5	5.6	0.9	16.0
Bordier	12.4	11.4	1.0	8.8
Totals	26.4	23.4	3.0	Average 12.8
<i>Varieties treated with nitrate of ammonia.</i>				
Red Tuscan	10.5	10.0	0.5	5.0
Solid Straw Tuscan.	10.1	7.6	2.5	33.0
White Tuscan	8.3	6.7	1.6	23.9
Glynus	7.0	6.3	0.7	11.1
Pearl	8.0	5.8	2.2	37.9
Totals	43.9	36.4	7.5	Average 20.6

ROOT CROPS

996 — **New Blight-proof Variety of Potatoes.** — *Queensland Agricultural Journal*, Vol. II, Part 2, pp. 103-106. Brisbane, August 1914.

A new variety of potatoes called the "New Era" has been obtained by a farmer who is also a keen student and observer, Mr J. G. Harris, of Raetihi, New Zealand. In the locality in which the potato was produced it has proved blight and frost proof; it is suitable to grow for the early potato trade and, it is stated, has produced up to 20 tons per acre.

The origin of this potato is as follows: six years ago Mr. Harris had an acre and a half in potatoes, Eldorados and Northern Stars. The potato blight swept the whole crop with the exception of one plant. Its tubers were multiplied during the next five years, and proved resistant to blight, while the above-mentioned varieties, as well as Irish Rock, Up-to-date and Gamekeeper (1), were all attacked.

FORAGE
CROPS.MEADOWS
AND PASTURES

997 — **Grasses at Hawkesbury Agricultural College, New South Wales.** — BREAKWELL, E. (Agrostologist) in *The Agricultural Gazette of New South Wales*, Vol. XXV, Part 8, pp. 653-656 + 11 figs. Sydney, August 1914.

Although the soil at Hawkesbury Agricultural College is not of a good character there are many grasses which stand the adverse conditions remarkably well.

The principal of these are: *Eragrostis leptostachya* Steud. (Paddock Love-grass), a native grass, particularly adapted to soils of a light or sandy nature; it is a heavy seeder and the seeds appear capable of

(1) See also No. 791, B. August 1914.

(Ed.)

easy germination. *Eragrostis curvula* and *E. curvula* var. *valida* have been recently introduced from America and are particularly adapted for growing under adverse conditions, such as light soils and low rainfall; they produce, however, a coarse fodder. The latter of the two has a thick growth about 3 feet high and seeds heavily.

Andropogon intermedius (Blue grass). This is a native grass; its habitat is on alluvial formations or on moist black soils in general; nevertheless it appears particularly adapted to the poor soil of the College. The grass is a heavy seeder, but so far the seed has not germinated very well; on the other hand root planting has been very successful. It yields a heavy succulent flag, which remains green from September well into May. It is very sensitive to frosts. At the College it is often attacked by a fungus (*Cerebella* sp.).

Poa arachnifera (Texas Blue grass), is the most vigorous of the Poas and appears well adapted to the light soils. Propagation by seed is uncertain, but it readily spreads if root planting is resorted to.

Poa pratensis (Kentucky Blue grass). — It quickly covers the ground. At the College it suffers very much in the summer.

Poa sempervirens (Evergreen-Meadow grass). — This grass is really a variety of *Poa nemoralis*; it remains perfectly green during the heaviest of frosts, and it grows fairly vigorously during the colder months of the year. Its texture is also finer than that of most of the other Poas.

Poa compressa. — Although this grass produces only a small quantity of foliage, it is very nutritive and remains green during the greatest part of the year. Its vigour at the College shows its adaptability to poor soils, and its capability of enduring a limited rainfall is shown by its permanent character at the Cowra Experiment Farm.

Pollinia fulva (Sugar grass). — A native grass; its flag is very succulent and it is particularly drought resistant; it will also stand a large amount of feeding off. At Hawkesbury, however, the production of seed has been somewhat disappointing.

Bromus inermis (Awnless Brome grass). — This is a native of Europe, and a grass which has met with great success in the United States of America. It remains green the greater part of the year and stands the summer better than *Bromus unioloides*. It is very nutritive and stands grazing well.

Bromus unioloides (Prairie grass). — A very succulent grass, which produces a large quantity of feed during the cooler months of the year. Under cultivation it yields heavily, and when cut for hay the new plants spring from the old root, becoming perennial in habit; but when stocked it disappears rather suddenly, behaving as an annual.

Bromus pumpellianus. — This is one of the newer bromes. It has so far made a promising growth, while *B. sterilis*, *B. maximus* and *B. mollis* have proved useless.

Chloris gayana (Rhodes grass). — Having already proved successful, the cultivation of this grass has spread rapidly; for producing the quickest growth on the lighter soils, it appears to have no equal. It seeds heavily.

Chloris barbata (Australian Rhodes grass), *Paspalum dilatatum* and *Setaria nigrirostris*, which has given good results in the Transval; at the College it has grown vigorously, while at the same time its flag does not become coarse.

Phalaris bulbosa is one of the best winter grasses introduced at the College.

Festuca elatior does well on the poor soils of the College and stands the dry summers fairly well.

F. arundinacea is largely cultivated in New Zealand.

F. ovina, *F. rubra*, and *F. duriuscula*. — All these grasses will grow in light soils, but they have finer leaves and smaller growth than the two previously named.

998 — **Senegal Perennial Rice (1) as Forage.** — WOOD, C. E. (Manager, Kamerunga State Nursery) in *Queensland Agricultural Journal*, Vol. II, Part 2, pp. 154-157 + 5 figs. Brisbane, August 1914.

Mention having been made of the existence of a perennial rice in Senegal, French West Africa, the Queensland Department of Agriculture procured a small parcel of seed which was tried at the Kamerunga State Nursery. The germination of a parcel of seed received in 1913 was fairly good; planted out in the open in January it was in flower by the end of May.

Perennial rice is a good forage, relished when green by cattle and horses, and it also yields a good hay. It has, however, the drawback of producing only a very limited quantity of seed. The panicles are few and bear from two to ten grains, the other glumes being empty. Owing to the scarcity and leanness of the grain it is not likely to be of any use for human consumption in its present form in Queensland.

999 — **Drought-resistant Grasses and Fodder Plants.** — BREAKWELL, B. A., in *The Agricultural Gazette of New South Wales*, Vol. XXV, Part 5, pp. 385-386. Sydney, 1914.

The exceptionally dry summer through which the interior of New South Wales has just passed provided a good opportunity of investigating those plants which best endured the drought.

It was observed that of the plants growing in the Experiment Farms, the following, tabulated in order of drought resistance, were the most prominent grasses: *Panicum bulbosum* (Experiment Farms at Wagga, Bathurst and Cowra), introduced from America.

Panicum prolium — Coolah grass (Wagga, Bathurst, Nyngan), native.

Andropogon bombycinus — Silky heads (Wagga).

A. intermedius — Rare blue grass (Cowra and Nyngan).

A. erianthoides — Satin top grass (Cowra).

Panicum floridum — (Cowra, Bathurst and Wagga).

Chloris gayana (Wagga, Nyngan and Cowra).

Poa arachniifera — Texas blue grass (Cowra and Bathurst).

Other iodder plants :

Medicago media — Sand lucerne (Wagga and Nyngan). This lucerne originated as a cross between the yellow-flowered lucerne (*Medicago falcata*) and the common lucerne (*M. sativa*), and in power of drought resistance exhibits the characteristics of the former. It also differs from the ordinary lucerne in having a procumbent growth; this renders it more suitable for pasture than for hay, but makes it a poorer seeder than Tamworth lucerne.

Poterium Sanguisorba — Sheeps' burnet (Wagga).

Vicia dasycarpa — (Bathurst).

1000 - Cowpeas (*Vigna catjang* Endl.; *Vigna unguiculata* Walp.) in New South Wales. — HADFIELD, J. W. (Instructor in Agriculture, Hawkesbury Agricultural College) in *The Agricultural Gazette of New South Wales*, Vol. XXV, Part 8, pp. 657-661 + 2 plates. Sydney, August 1914.

The cultivation of cowpeas is spreading from year to year in New South Wales, where it began to become general between 1890 and 1892. To its early development the Department of Agriculture cooperated by distributing large quantities of seed in small lots. It is now distributed in nearly all the warmer parts of the State, though the production of seed is still largely confined to the North Coast District.

As a rule the crop is sown in rows 2 ft. 6 in. to 3 ft. apart and the seed from 6 to 9 in. apart in the rows. This enables the crop to be cultivated. Sowing with a drill is much better than broadcasting and harrowing in, for if in this case heavy rain falls a quantity of seed may become exposed and does not germinate. As with other legumes, nodules form on the roots of cowpeas, whence frequently the second and successive crops succeed better than the first, and but rarely require nitrogenous manures of any kind. In manurial trials at the Hawkesbury College phosphoric acid was proved to be the most important manurial ingredient. Sulphate of potash, though it increased the yields, was too expensive, while nitrate of soda and sulphate of ammonia were decidedly detrimental, reducing the yield to one half that of the unmanured plots.

The varieties of cowpeas are very numerous. The Black is the most popular, while the Poona, a variety introduced from India, has rivalled if it does not excel the Black at the College in the production of green fodder; but when grown for seed it does not ripen its pods so evenly. Both are late maturing, while the White or Black Eye and the Upright-growing are early; the Iron is a mid-season variety and it is claimed to be immune from the attacks of eelworms.

Cowpeas form a very valuable green manure crop for orchard and general farm work, though it is difficult to plough the vines in. At Hawkesbury it is usual to roll the crop first, and then after running over it with a disk cultivator to plough it in with a single-furrow disk plough. The crop should be ploughed in soon after the pods are set, as at a later stage the stems become woody. Considering its very high feeding value, the writer considers ploughing in the whole crop as being sometimes a very wasteful practice. If the crop be fed off on the ground where it is grown, at least

50 to 75 per cent. of the manurial value will be returned, while the full feeding value of the crop will also have been obtained.

As fodder crop, cowpeas give a better balanced and somewhat more abundant fodder when they are grown with maize, or still better sorghum and millet.

A system that has proved very profitable on the North Coast is to sow the cowpeas down between the rows of early corn. They are sown with a maize dropper immediately after the last cultivation of the corn, which should be not later than January if it is intended to harvest the cowpeas for seed. Yields of 10 bushels per acre are quite common, and sometimes even 16 bushels.

Cowpeas by themselves usually form an inferior kind of silage, often acid in character and poor in colour and smell, and more or less decomposed. They are much better when mixed with sorghum, maize or millet. American experience indicates that the best plan is to broadcast the cowpeas at one bushel per acre, and the sorghum or kaffir corn at about 10 lb. of seed per acre.

If cowpeas have to be cut and turned into hay a difficulty is met with, as there is no satisfactorily rapid method of harvesting. Machinery for the purpose has been devised, but hitherto without much success. Cowpea makes good hay, but its leaves fall very readily when dry and without the greatest care the loss will be considerable. The upright-growing varieties, such as Poona and Upright-growing, especially when grown thickly, can be harvested with a scythe and sometimes with a mower.

No machinery for the purpose of harvesting the pods has been perfected, and with present methods the whole plant has to be harvested and threshed, or the pods picked by hand. Three cwt. of these peas in the pod give, when threshed, one bag of peas weighing 240 lb.

The sale prices of cowpeas in New South Wales have been practically stationary during the last twenty years, namely, for the Black cowpeas about 10s per bushel on the Rivers and about 12s 6d. delivered at Sydney to seedsmen. The average retail price for cowpea seed is about 15s per bushel. The price of Poona, which has a very small seed, is usually something over £1 per bushel.

FIBRE CROPS

1001 - **Flax Experiments in Ireland.** — *Department of Agriculture and Technical Instruction for Ireland, Journal*, Vol. XIV, No. 3, pp. 515-534. Dublin, 1914.

Manurial experiments. — The following is a summary of the results obtained from the two series of experiments conducted by the Department during the eight years 1901 to 1908 inclusive :

1. The use of potash manures gave profitable increases; kainit and chloride of potash showed almost equal merits, were more regular in their effects and, on the average, gave better results than sulphate of potash.
2. The application of kainit and chloride of potash in winter gave results as good as when these manures were applied at the time of sowing.

3. Phosphatic manures, when applied either singly or in combination with a potash manure, or as part of a complete mixture, encouraged the growth of weeds at the expense of the flax, and their use was almost invariably attended with a loss, and very frequently even with smaller yields of scutched flax.

4. In some seasons profitable increases were obtained from the addition of the nitrogenous manure, rape meal, to kainit. Its effects, which appeared to depend on the nature of the season, were too irregular to warrant the general adoption of such a mixture in preference to the kainit or chloride of potash dressings now so commonly used.

5. The application of agricultural salt was not remunerative.

As in these two series of experiments the results obtained from the addition of a nitrogenous to a potassic manure were very irregular, it was considered advisable to carry out a third series of experiments with sulphate of ammonia added in varied proportions to chloride of potash. Still further, as the application of phosphates as superphosphate or basic slag resulted in a loss, it was also decided to test bone flour as part of a complete mixture.

This third series of experiments was started in 1909 at ten centres and repeated in 1910 and 1911 in eight and nine centres. The following dressings per statute acre were tested :

Plot 1. — Unmanured.

2. — $\frac{1}{2}$ cwt. chloride of potash.
 $\frac{1}{2}$ cwt. sulphate of ammonia.
3. — 1 cwt. chloride of potash.
 $\frac{1}{4}$ cwt. sulphate of ammonia.
4. — 1 cwt. chloride of potash.
 $\frac{1}{2}$ cwt. sulphate of ammonia.
5. — 1 cwt. chloride of potash.
 $\frac{1}{4}$ cwt. sulphate of ammonia.
— 2 cwt. steamed bone flour.
6. — 1 cwt. chloride of potash.

Whilst in 1911 the summer was extremely warm and dry, in 1912 it was abnormally wet and cold.

The average results per acre from the application of the different manures to the flax crop were as follows :

Number of plot	1	2	3	4	5	
Yield of retted flax . . .	3 229 lb.	3 614 lb.	3 593 lb.	3 739 lb.	3 294 lb.	3 285 lb.
» of scutched flax, . . .	33 st. 12 lb. 38 st. 11 lb. 37 st. 5 lb. 39 st. 13 lb. 31 st. 2 lb. 35 st. 1 lb.					
Returns from flax and tow	£14 8s. 8d.	£16 13s. 5d.	£16 3s. 0d.	£17 12s. 9d.	£12 19s. 9d.	£14 16s. 9d.
Cost of manure	—	12s. 6d.	13s. 6d.	17s. 6d.	£ 1 4s. 3d.	10s. 0d.
Estimated profit from use of manures	—	1 12s. 3d.	£ 1 0s. 7d.	£ 2 6s. 7d.	£ 2 13s. 2d. (loss)	1s 11d. (loss)

In valuing these results it must be borne in mind that contrary to usual experience the flax on the unmanured plots in 1912 showed no signs of yellowing, which caused the advantage derived from chloride of potash alone (Plot 6) to disappear.

Plots 2 and 3 showed a profit over Plot 6 in the years 1909, 1910 and 1912 and a loss in 1911; Plot 4 yielded a profit in 1910 and 1912 and a loss in 1909 and 1911. These different results cannot be attributed to the respective fertility of the various soils; it appears more probable that they are due to the climatic condition of the seasons. No definite recommendation can therefore yet be made as to the use of sulphate of ammonia with chloride of potash. Plot 5 showed that when given under the form of bone flour phosphates caused a loss: they favoured the growth of weeds and diminished the yield in scutched flax.

Liming experiments. — An experiment designed to test the value of liming was made on four plots, each one quarter of an acre in extent. After the application of the lime in 1911 all plots were cropped with oats and in 1912 with flax.

The treatment of the respective plots per acre was as follows:

Plot	1911 Oats	1912 flax
1.	no lime	no chloride of potash
2.	no lime	1 cwt. do. do.
3.	1 ton burnt lime . . .	no chloride of potash
4.	1 ton burnt lime . . .	1 cwt. do. do.

The average results per acre are shown in the following table:

Number of plot	1	2	3	4
Yield of retted flax	2 724 lb.	3 142 lb.	2 896 lb.	3 343 lb.
Yield of scutched flax . . .	37 st. 8 lb.	44 st.	42 st.	47 st. 8 lb.
Value of scutched flax . . .	£16 3s. 2d.	£18 6s. 9d.	£18 6s. 9d.	£20 15s. 0d.
Cost of manure	—	10s.	5s.	15s.
Estimated profit	—	£ 1 3s. 3d.	£ 2 2s. 1d.	£ 3 17s. 0d.

Seed trials. — Each year since 1901 experiments have been conducted with seed imported by the Department of Agriculture for Ireland direct from Holland and Russia, in comparison with Dutch and Russian seed imported by Ulster merchants. The results are given in the following table:

	Russian seed imported by the Department	Belfast brand of Riga seed	Dutch seed imported by the Department	Belfast brand of Dutch seed	Irish seed and year of selection
Average 1901-1911, excluding 1903. Yield of scutched flax per acre	£14 15s. 6d.	£13 17s. 0d.	£14 11s. 5d.	£13 11s. 6d.	—
1912. Yield of scutched flax per acre	£14 8s. 7d.	£14 4s. 6d.	£15 1s. 0d.	£14 3s. 6d.	£8 18s. 8d.
1912. Yield of scutched flax per acre	35 st. 1 lb.	34 st.	38 st.	36 st. 1 lb.	22 st. 3 lb.

From these and preceding experiments the conclusions may be drawn that the variety of flax seed to be sown (whether Dutch or Riga) should not be governed by the class of soil for which it is intended but by the quality of the seed itself, which depends on the climatic conditions prevailing in the seed-producing countries. Thus in 1910 and 1911 Russian seed gave the better average results on the various classes of soil, while in 1909 and 1912 the Dutch seed proved the more productive. Farmers should, therefore, before purchasing seed, consult the leaflets of the Department which give information as to the harvest conditions during the previous year in Holland and Russia.

In comparative seed tests, "Pernan Crown" seed, another seed selected and grown on a farm in Russia for a number of years, Irish seed and Dutch Riga Child were tested. The first gave, on the whole, better returns than the second, and both better than the Dutch Riga Child. The crops from the selected Irish seed were much inferior.

Other tests were made with Irish seeds saved from the same crop, but at different stages of maturity. The perfectly ripe seed yielded 41 st. 10 lb. of scutched flax per acre, or 16.72 per cent. of the retted straw, the average returns of flax and tow per acre being £18 16s. 9d. The immature seed yielded 39 st. 10 lb. of scutched flax, or 16.60 per cent, and the total value of flax and tow was £15 19s. 7d. The higher return from the crop produced by the ripe seed is mainly due to the superior quality of the fibre.

In 1911 tests were commenced and will be continued on a large scale with a view to determining if it be possible to produce flax seed successfully in Ireland and to improve it for fibre production by selecting from long stalks. It has been observed that seeds detached from the stalks in the autumn and stored in granaries lost in germinative qualities, and that it is preferable not to ripple it until the following spring and to store the dried flax straw in small lots during the winter in lofts with open windows so that all the seed boll ends are exposed to a current of air. This straw was rippled in the latter end of February.

A definite conclusion cannot yet be drawn from these experiments. As the following table shows the selected Irish seed yielded less than the Pernan Crown, but a scutched flax of higher value.

	Selected Irish seed	Pernan Crown seed
Yield of dried retted straw per acre	25 cwt. 1 qr. 4 lb.	26 cwt. 1 qr. 20 lb.
Yield of scutched flax per acre	33 st. 2 lb.	36 st. 0 lb.
Percentage of scutched flax from retted straw . .	16.38	17.02
Value of scutched flax per cwt.	8s. 2d.	7s.
Value of scutched flax per acre	£16 16s. 3d.	£17 2s. 0d.

1902 - Contribution to the Study of the Lodging of Hemp. — HAINSCH, HEINRICH, in *Mitteilungen der landwirtschaftlichen Lehrkanzeln der K. K. Hochschule für Bodenkultur in Wien*, Vol. II, Part 4, pp. 607-674. Vienna, August 8, 1914.

This study contains a detailed account of the cultural conditions of the experiment and the results of the examination of the hemp straw, the observations and measurements taken during growth, microscopic examination of the stems, determination of resistance to lodging and chemical analysis.

The possibility of lodging depends on the lower portion of the stem, and it is necessary to consider the histological conditions in this region in order to judge the resistance of the stem. Transverse sections at the base of lodged plants show a reduction of lignified fibres, and an increase of parenchyma. The pith is also generally more abundant in lodged stems and the lignified fibres are often arranged symmetrically, thus reducing the mechanical resistance along the line of symmetry. The histological differences between lodged and unlodged plants disappear in the upper parts of the stems.

The cells of the fibrous tissue of lodged plants are smaller, round and with a larger lumen. The fibres are smaller and less dense. As a result of lodging the growth of the cells is checked and they remain diminutive. The relative thickness of the cell-walls diminishes with lodging, but only in the lower portion of the stem. As a result of direct determinations of the resistance of the stems, it appears that the mechanical constants of the tissues are not influenced by the thickness of the cell-walls or of the stem.

Lodging considerably diminishes the mechanical resistance of the cells; the resistance of the stems to lateral forces is directly proportional to their weight, provided the thickness of the cell-wall is not abnormal. It has not been found that the degree of lignification has any influence on the power of resistance of the cells, though it is certainly greater on the lower portions of the stem.

Lodged plants show a higher percentage of ash. The percentage of silica diminishes from the base to the top of the stem and is greater in lodged plants, but as its total quantity is so small it cannot have any effect on the resistance to lodging; similarly also with regard to the percentage of calcium.

1003 - **Hemp Production in the United States.** — *Daily Consular and Trade Reports*, Issued by the Bureau of Foreign and Domestic Commerce, Year 17, No. 177. Washington, July, 30, 1914.

The falling off in the domestic production of hemp is due primarily to the increasing difficulty in securing sufficient labour to take care of the crop, to the lack of labour-saving machinery, to the increased profits in raising stock, tobacco and corn, and lastly to the rapidly increasing use of other fibres, especially of jute.

During the past three years interest in the hemp industry has been re-awakened, and experiments are being tried with a view to the cultivation of the crop in new areas, such as large extents in the valley of the Mississippi and its tributaries, and in the Sacramento and San Joaquin Valleys in California.

Hemp cannot be economically grown in areas of less than 50 acres in any one locality, so as to warrant the use of machinery for harvesting and breaking.

The following is a general estimate of cost and returns for such an area of 50 acres :

Cost:	\$
Ploughing (in fall) 50 acres, \$ 2 per acre	100
Disking (in spring), 50 cents per acre	25
Harrowing, 30 cents per acre	15
Seed, 40 bushels, delivered, \$ 4.50 per bushel	180
Seeding, 40 cents per acre	20
Rolling 30 cents per acre	15
Self-rake reaper for harvesting	75
Cutting with reaper, \$ 1.50 per acre	50
Picking up from gavels and shocking, \$ 1 per acre	50
Spreading for retting, \$ 1.50 per acre	75
Picking up from retting swath and setting in shocks, \$ 1.40 per acre	70
Breaking 50 000 lbs. fibre, including use of machine brake, 1½ cents per lb.	750
Baling 125 bales (400 lbs. each), including use of baling press, \$ 1.40 per bale	175
Marketing and miscellaneous expenses	150
Total cost	<u>\$ 1 750</u>
Returns:	
Long fibre 37 500 lbs., 6 cents per lb.	2 250
Tow 12 500 lbs., 4 cents per lb.	500
Total returns	<u>\$ 2 750</u>

1004 - **Cotton in Paraguay and Argentina.** — *Boletín del Departamento Nacional de Fomento*, Year 1914, No. 5, pp. 5-31. Asunción, May-June, 1914.

The results of an enquiry on the cultivation, marketing and trade in cotton made by the "Departamento Nacional de Fomento" of Paraguay are here presented.

Cotton in Paraguay. — Suitable cotton soils are plentiful in Paraguay and the crop was formerly grown in all districts. According to statistics for 1863 the yield was nearly 5 000 000 lbs. of ginned cotton.

All the best varieties except Caravonica have been tried in Paraguay, and it has been found that the tree cottons are more suitable to the climate

especially *Gossypium barbadense*, with *G. peruvianum* and *G. maritimum* which are really varieties of it. These like abundant rains, and Paraguay is more favoured in this respect than any other cotton-growing country. Good results have also been obtained at some places, in particular at the Agricultural Experiment Station of Puerto Bertoni, with varieties of *G. herbaceum*, especially Peterkin, Hawkins, and Allen. These varieties succeed in places where the others will not do, as in poor shallow soils. *G. barbadense* *rufum*, known in Paraguay as Mandipwita, is indigenous. It is used to a certain extent in the industry and sometimes makes a good price. If a steady market could be obtained for it, this species of cotton would be of great importance, since it yields well and is more resistant than other species.

Seeding is effected from June to the beginning of September; with late sowing the yield of the first crop is reduced, but the second is much greater. Sr. M. S. BERTONI made a successful experiment of sowing in January and February between rows of maize; if the maize is not sown too thickly the cotton grows well, though slender, and is protected from the cold. If cold weather prevails after the maize is harvested, the cotton is cut down to the ground, but if there is no likelihood of frost the young plants are left as they are. When the warm weather returns they grow rapidly and at the end of November the bolls begin to ripen.

Harvest begins in December, or January, or at the latest February, for the first year's crop and continues until the cold season or, if there is no fear of frosts, until June or July when the flowering period ceases and growth of the branches begins. In districts exposed to frost the plants are cut back in May, and the unopened bolls are collected and dried in sheds until they open: these pods yield the cleanest cotton.

Sr. Bertoni considers the yield per acre in Paraguay as the highest in the world, the average yield of the country being 534 lbs. per acre. At the experiment station at Puerto Bertoni he has obtained yields of 710 to 890 lbs. per acre of ginned cotton.

The following figures show the comparative yields of the different countries (in lbs. per acre):

	Minimum	Average	Maximum
Italy and Spain	68	135	225
Africa	90	180	360
United States	126	200	604
Argentine	180	305	630
Paraguay	360	540	923

In spite of natural conditions so favourable, the cultivation of cotton has not been seriously developed owing to a number of social factors.

Cotton in the Argentine Republic. — The following data have been obtained from the "Dirección General de Comercio e Industrias" of the "Departamento de Fomento" of the Argentine.

Almost all the Argentine cotton is produced in the region of Chaco, in loamy soils; the rainfall is 80 to 150 cm. (32 to 60 in.), fairly well distri-

buted. The common varieties grown are Texas Woods, Culpeper, Simkin, King, Russell, Peterkin, Allen, etc., all of American origin and of short staple. The "Departamento de Fomento" has begun a policy for the standardisation of the cotton of Chaco. The estimated area of cotton in 1914 is about 7000 acres; it would have been much greater but for the depredations of locusts and prolonged drought. The average yield is about 1340 lbs. per acre of raw cotton, but of recent years it has been only 1080 lbs. per acre. Unginned cotton is bought by local merchants, who gin it and pack it for export. The seed is partly exported and partly used locally for oil extraction. Under normal conditions an acre of cotton yields a profit of £3 10s to £5 10s; the initial expenditure, together with cost of seeding and picking, may be estimated at the same sum. Owing to scarcity of labour, the extension of this crop presents difficulties.

1005 - The Indian Jute Industry. — *The Agricultural Gazette of New South Wales*, Vol. XXV, Part 7, pp. 577-580. Sydney, July 1914.

The following data are taken from a report drawn up by J. B. SUTTOR, who was instructed by the Minister of Agriculture of New South Wales to visit the jute-producing districts of India.

India has practically a monopoly of the production of jute, the result being that the market fluctuates to a great extent and is subject to much speculation. The world's annual demand for raw jute is estimated by the Commercial Intelligence Department of India at about 1 700 000 tons; 791 000 tons is the estimated mill consumption; the surplus is exported to the following countries:

England	340 000 tons
Germany	180 000 "
U. S. America	124 000 "
France	86 000 "
Other countries	179 000 "
Total	909 000 "

The jute manufactures represent 40 per cent. of the total value of exports of Indian manufactures, and the raw jute over 26 per cent. of Indian raw materials exported. During the financial year 1912-13 the exports of jute fabrics to the principal countries were as follows:

	Amount — £	Principal form of export —
U. S. America	5 840 333	Cloth
Argentina	1 944 687	"
Australia	1 433 733	Bags and bales
England	960 933	" cloth
Chile	564 067	Bags
China	530 200	"

The above countries are followed in decreasing order by Canada, Java, Egypt, West Indian Islands, Straits Settlements, etc.

Bengal is the chief jute-producing centre of India. The area under jute is estimated at 3 400 000 acres and that an average crop yields about 1000 lbs. of jute fibre per acre, the quality of which is largely governed by soil and climatic conditions. The most satisfactory results are obtainable from rich loams provided with plenty of moisture. Jute is mostly grown in small holdings and solely worked by natives. The soil is frequently ploughed several times to pulverize it thoroughly before sowing. No special care appears to be bestowed on seed selection. The sowing takes place from February to April, broadcasting being generally adopted: about 8 lbs. of seed to the acre are used. While moisture is necessary, the jute areas are not irrigated except in cases where there is a falling off in rainfall or a great absence of humidity.

When the crop is about to flower, it is harvested. The stalks are then generally from 4 to 12 feet high or even more, according to climatic conditions. The harvesting takes place from June to August and sometimes up to September. The bundles of jute stems are submerged in water to rot for 10 or 15 days; then the fibre is removed from the core by hand with the help of very primitive implements, after which it is dried and bleached in the sun for two or three days.

The fibres are collected in small bundles and are then ready for sale. There are usually three middlemen between the grower and the mill or manufacturer. The bales for the local mills weigh 330 lbs. and those for exportation 400. The raw jute is classified as follows:

No. 1 quality, 80 to 90 per cent. suitable for Hessian warp and 10 to 20 per cent. of weft.

No. 2 quality, 60 to 70 per cent. of the former, and 30 to 40 per cent. of the latter.

No. 3, 70 per cent. of sacking warp and 30 per cent. of weft.

No. 4, 40 per cent. of weft.

For foreign markets the standard quality is usually quoted as of M group or "cracks", and means an equal proportion of No. 2 and No. 3 qualities.

Besides the above there are also lower grades called "cuttings" and "rejections".

In the mills the jute passes first of all through a softening machine with fluted rollers; it is then carded and spun. Thence it proceeds to the looms and when woven it passes through a callender with rollers heated up to 600° F., giving a smooth surface. In the case of cloth for wool bales, the fabric passes through another machine known as the "cropper", which removes any loose fibres from the surface of the cloth in order to avoid any jute fibre getting mixed with the wool.

1006 - Composition of Essence of *Artemisia arborescens* and of *A. Absinthium* collected in Italy. — 1. JONA, T., in *Annali di Chimica applicata*, Vol. II, No. 3 and 4, pp. 63-68. Rome, 1914. — 2. PAOLINI, V., and LO MONACO, R., in *Atti della Reale Accademia dei Lincei, Rendiconti di scienze fisiche, matematiche e naturali* Vol. XXIII, Part 4, pp. 123-129. Rome, August 16, 1914.

I. — The essence of *Artemisia arborescens* was obtained by the distillation of the dried tops collected near Sassari (Sardinia), a little before flower-

ing. The yield was 0.57 per cent. of essence, with the following characters: deep blue colour, aromatic, slightly mobile, density at 15° 0.9458, soluble in 10 volumes of 80 per cent. alcohol and in all proportions of 90 per cent. alcohol, contains no nitrogen or sulphur, saponification value 29.3, acid value 9.8, etherification index 19.5. At normal pressures the essence distils between 90° and 210° C.

According to the researches of the writer it contains: a) 13.94 per cent. of alcohol of the formula $C_{10}H_{18}O$ (thuyol and a small quantity of another alcohol, probably borneol), 8.58 being free and 5.36 combined with fatty acids; b) formic, acetic, isovalerianic, pelargonic, palmitic and stearic acids, partly in combination with the above-mentioned alcohols; c) about 13 per cent. of β thuyone; d) a mixture of hydro-carbons of high boiling-point.

2. — Essence of *Artemisia Absinthium* obtained from fresh cultivated plants grown near Rome and Perugia, by distillation in a current of vapour gave the following analysis: a) about 10 per cent. of thuyone, consisting of the isomeric β dextro-rotary and the isomeric α thuyone; b) about 48 per cent. of thuylic alcohol, free and in combination with acetic, isovalerianic and palmitic acids; a mixture of at least two chemical compounds in which dextro-rotary δ thuylic alcohol predominates; c) phellandrene; d) cadinene; e) a blue oil of unknown composition.

1007 — Two Crosses of Strong Tobacco in Italy. — AIELLI DONNARUMMA, in *Bollettino tecnico della coltivazione dei tabacchi*, Year XIII, No. 1, pp. 7-8. Scafati, January-February 1914.

With a view to improving the type of plant and the shape of the leaves of strong hybrids obtained by crossing "Italia" tobacco with Kentucky and Salento \times Kentucky, crosses were made between the two hybrids themselves. The parental forms were immune from *Thielavia basicola* which causes so much damage to Kentucky tobacco. Four of the typical hybrids were selected, two of each kind, and reciprocal crosses were made. Thirty flowers were crossed and 30 seed capsules obtained. In the following year the two hybrids Italia-Kentucky \times Salento-Kentucky and Salento-Kentucky \times Italia Kentucky, were grown in land freely infested with disease and in which the Kentucky variety had failed during previous years. Although the season was not very favourable the two crops succeeded admirably. No plant showed the least attack of *Thielavia*, and the growth was so rapid that they considerably out-grew the rows of control plants in the centre of the plots.

The object of the cross was completely attained in the new hybrids, which combined the length of leaf of the Italia-Kentucky parent and the breadth of leaf of the Salento-Kentucky parent. The characters of the parents were so completely combined in the offspring that it required an experienced eye to distinguish between the reciprocal crosses. Cultural experiments will be made to ensure constancy of type.

1008 — *The Chemical Composition of the Tobacco Plant in its Various Stages of Growth.* — Note I, on Xanthi Yaka grown in the Abruzzi. — *Communicated to the Institute by Professor E. PANNAIN, of the Royal University of Rome.*

With a view to contributing to the knowledge of the tobaccos grown in Italy and of resolving certain problems of biological and technological chemistry, it was considered advisable to determine the variation in chemical composition of the plant during its growth and the effects produced by the different treatments of drying and fermenting to which the green leaves are subjected during the process of manufacture. These results were obtained in researches on the variety Xanthi Yaka, grown at Francavilla al Mare (Abruzzi). Analyses were made of seedlings in the nursery, plants before flowering, ripe leaves from each picking and the bare stems and roots remaining in the field after harvest.

In this preliminary study the following determinations were made of different parts of the plant after drying in a water oven: ash, total nitrogen, nicotine, organic acids, ether extract, alcoholic extract. Ordinary methods were used except in the case of nicotine, for which a slight modification of Keller's process was preferred on account of its rapidity: the nicotine was displaced by 20 per cent. potash and extracted by a mixture of equal parts of sulphuric and petroleum ether, then titrated against $\frac{N}{10}$ sulphuric

TABLE I. — *Analyses of seedlings.*

Parts analysed	Ash	Total nitrogen	Nicotine	Organic acids	Ether extract	Alcohol extract
Leaves	15.92	4.45	1.13	5.03	9.03	21.84
Stem	18.40	2.90	0.48	5.40	8.20	21.40
Roots	14.33	3.04	0.80	3.93	4.00	12.00
Whole plant	15.85	3.81	0.65	4.45	7.30	18.10

TABLE II — *Analyses of plants before flowering.*

Parts analysed	Ash	Total nitrogen	Nicotine	Organic acids	Ether extract	Alcohol extract
Leaves from middle and lower portion of plant. { whole . .	10.50	2.86	1.18	3.56	8.01	23.80
blade . .	10.40	2.92	1.23	3.47	8.30	24.90
ribs . .	10.60	2.02	0.80	4.01	5.06	16.21
complete .	11.10	4.30	0.89	3.36	9.21	24.50
Apical leaves . . . { blade . .	12.45	4.70	0.91	3.45	9.45	25.50
ribs . .	10.55	2.08	0.81	4.01	5.00	16.15
Stems	6.40	1.25	0.29	3.65	2.40	21.10
Roots	6.85	1.69	0.65	4.23	1.85	18.60

acid with congo red as indicator. The organic acids were displaced by sulphuric acid 1 : 3, extracted with ether, titrated against soda using phenolphthalein as indicator, and expressed as oxalic acid.

The seedlings were analysed as a whole as well as in portions, and gave results as shown in Table I.

The analyses of the plant before flowering are given in Table II.

The leaves harvested at the 1st (basal), 2nd, 3rd and 4th (apical) periods were analysed whole and in parts (blades and ribs). The bare stems and roots remaining in the field were also analysed. The results are set out in Table III.

TABLE III — *Analyses of leaves of the various pickings.*

		Ash	Total nitrogen	Nicotine	Organic acids	Ether extract	Alcohol extract
1st picking .	whole leaves . .	16.10	1.57	1.42	4.61	9.95	32.15
	blades	16.40	1.69	1.56	4.50	10.15	32.75
	ribs	14.70	1.23	0.46	4.64	4.90	24.95
2nd picking .	whole leaves . .	12.30	1.00	1.52	4.52	10.00	34.15
	blades	12.35	1.02	1.94	4.50	10.40	40.55
	ribs	12.10	0.77	0.73	4.54	4.90	27.35
3rd picking .	whole leaves . .	8.55	1.26	0.75	3.75	9.65	45.10
	blades	8.25	1.35	0.84	3.52	10.40	46.05
	ribs	9.80	0.96	0.24	3.91	3.15	33.60
4th picking .	whole leaves . .	7.50	1.50	0.74	4.07	10.80	43.25
	blades	7.20	1.58	0.81	3.76		
	ribs	9.00	1.34	0.32	4.95		
Bare stems		6.40	0.55	0.19	3.92	1.80	10.20
Roots		7.40	0.72	0.16	7.78	1.25	8.60

These results show that :

1. Seedlings are richer in ash, nitrogen and organic acids than half-grown or full-grown plants.

2. In plants before flowering, the apical leaves are richer in ash, nitrogen, and substances soluble in ether and alcohol than the lower leaves, but they contain less nicotine and organic acids.

3. In ripe leaves, the ash content decreases from the basal (1st picking) to the apical leaves (4th picking), and the leaves of the 1st and 2nd pickings are also richer in nicotine, containing double the quantity of the leaves of the 3rd and 4th pickings.

4. The leaf blades are always richer in nitrogen, nicotine and substances soluble in alcohol and ether than the ribs, and generally also in ash, but they are poorer in organic acids.

5. The stems and roots contain less ash, nitrogen, substances soluble in ether and alcohol, and nicotine than other parts of the plant, but the roots contain more nicotine than the stems.

1009 — **The Cultivation and Collection of Medicinal Plants in England.** — WHATMOUGH, W. A., in *The Journal of the Board of Agriculture*, Vol. XXI No. 6, pp. 492-510 + 13 figs. London, September 1914.

The cultivation of medicinal herbs in England began in very ancient times and gained gradually in importance with the decrease of uncultivated lands and of wild plants. During recent years the acreage devoted to drug cultivation has been more and more restricted by competition with wild foreign products; nevertheless English drugs and essences have still a reputation which allows of their being sold at about four times the price of the Continental article.

The limited outlet for most drugs makes overloading the market a comparatively easy matter; prices then become excessively low for the producer, with the result of restricted production, which in its turn leads again to high prices. As an illustration the writer instances Belladonna; in 1900 the supply of home grown Belladonna was in excess of the amount required for making green extract, and the price of the surplus leaves, after drying, was gradually reduced until being sold in competition with the wild foreign supplies they were disposed of at a loss. The result was that cultivation was practically limited to four drug farms having factories for making Belladonna preparations. But in 1912-13 there was an interruption in the continuity of Belladonna leaf and root exports from Croatia and Slavonia in South Hungary, the chief centres for foreign Belladonna; prices rose to such an extent that roots which realized 45s per cwt. in January sold for 150s before the end of August. Belladonna leaves from abroad, which sell at normal times for 45s to 50s per cwt., are now unobtainable at 1s per lb. In order to avoid as much as possible such fluctuations, the writer suggests adopting cooperation between growers and wholesale druggists.

The south of England is especially suited to drug growing and is further favoured by being close to the principal consuming market.

The writer then reviews the most important medicinal plants grown in England, namely:

Aconite (Aconitum Napellus L.). — The roots are mostly used, the leaves being of little importance. The chief collecting centres for the foreign root are the Swiss Alps, Salzburg, North Tyrol and Vorarlberg; Spain supplies some also and Japanese root (usually ascribed to *A. Fischeri* Reichb.) is plentiful.

Anise (Rimpinella Anisum L.). — It is cultivated at Westington near Chipping Norton, but the English climate is hardly warm enough to ripen the fruit properly and does not warrant further attempts at cultivation, even if market conditions, should be favourable.

Belladonna (Atropa Belladonna, L.). — The plant grows wild in the southern counties of England. When cultivated it yields an average crop of fresh herb in the second and third years of 5 to 6 tons to the acre. A second

crop is obtained in September in good seasons. It is sometimes attacked by a small beetle, *Epitrix atropae*. Paraffin and soap emulsion is stated to kill this.

Caraway (*Carum Carvi*, L.). — Caraway is largely grown in the Netherlands. In England it is mostly cultivated in Essex and Kent; it appears naturalized in some parts of Lincolnshire.

Chamomile (*Anthemis nobilis* L.). — Belgium is the chief grower of this plant. English chamomile is normally practically all used for distillation of oil. The yield of dry flowers is about 4 cwt. per acre. From 5 to 6 lbs. of fresh flowers yield 1 lb. of dry flowers.

Coriander (*Coriandrum sativum*). — Coriander is grown in Lincolnshire and East Anglia, often in conjunction with caraway. It yields about 15 cwt. per acre. English-grown coriander has the reputation of possessing the finest flavour.

Dandelion (*Taraxacum officinale* L.). — Ordinarily English roots are sold in competition with German roots. The yield is about 4 or 5 tons of fresh roots to the acre in the second year. A hundred parts of fresh root yield twenty-two of dry material.

Foxglove (*Digitalis purpurea* L.). — The Continental supplies come chiefly from Thuringia and the Harz mountains. It grows wild in England, and is also cultivated by a few growers; the yield is about 1 to 2 tons of fresh leaves per acre.

Dill (*Peucedanum graveolens* B. & H.). — It is grown chiefly in East Anglia, and produces from 5 to 7 cwt. of dill fruits per acre.

Fennel (*Foeniculum capillaceum* Gilibert). — The best fennel is supplied by France, Saxony and Russia. Fennel is largely used for cattle condiments. When grown in England it becomes an annual, and it would probably yield a crop of 15 cwt. per acre.

Golden Seal (*Hydrastis canadensis* L.). — Golden seal is an American drug. It was formerly so abundant in Ohio as to be considered a pestilent weed, but the drug collector and the improvement of land denuded the natural growing areas (deep shady nooks in forests with rich deep moist soil and now the supply is so limited that the price has quadrupled since 1905. In England it appears to be grown only in one locality — at the Wellcome Materia Medica Farm, near Darenth, Kent. It has also been successfully grown near Moscow in the shade of apple trees. In 1912 the United States Department of Agriculture reported that the cultivation of golden seal was "successfully established". After initial experiments commenced in 1899 by the above Department, 5120 lbs. of fresh roots per acre, corresponding to 1500 lbs. of marketable roots, were obtained.

Henbane (*Hyosciamus niger* L.). — This biennial is cultivated in England for the preparation of the extract; the dry commercial leaves imported from Germany and Russia are derived from the wild annual. The fresh leaves lose 80 per cent. of their weight on drying.

Egyptian Henbane (*Datura Metel* L.). — It thrives very well at the Wellcome Materia Medica Farm in Kent.

Opium Poppy (*Papaver somniferum* L.). — Though the crop is a precarious one, the white variety of opium poppy is still grown in several parts of England, notably Lincolnshire. Belgium ordinarily supplies a proportion of the poppy heads used in the United Kingdom.

Thorn Apple (*Datura Stramonium* L.). — It is not grown on a commercial scale in England; considerable amounts of the wild leaves are imported from Germany and Hungary. The demand for seed is very limited. About 34 parts of dry leaves are produced from 100 parts of fresh ones.

Datura Tatula is occasionally used in medicine in place of *D. Stramonium*.

Valerian (*Valeriana officinalis* L.). — Valerian is common in England in moist situations. Most of the rhizomes of commerce are grown in Derbyshire or imported from Holland, Germany and France. About 24 parts of the dry product are obtained from 100 of fresh rhizomes.

Other Medicinal Plants.

Experimental growing of some American drugs such as senega, grindelia, pokeroot and lobelia is made at Darent.

Medicinal herbs for sale are cultivated at Carshalton. The following are regularly grown:

- Balm (*Melissa officinalis* L.).
- Comfrey (*Symphytum officinale* L.).
- Feverfew (*Chrysanthemum Parthenium* L.).
- Greater Celandine (*Chelidonium majus* L.).
- Germander (*Teucrium Scorodonia* L.).
- Marsh Mallow (*Althaea officinalis* L.).
- Mugwort (*Artemisia vulgaris* L.).
- Pennyroyal (*Mentha Pulegium* L.).
- Rue (*Ruta graveolens* L.).
- Southernwood (*Artemisia abrotanum*).
- Tansy (*Tanacetum vulgare* L.).
- Wormwood (*Artemisia Absinthium* L.).
- Yarrow (*Achillea Millefolium* L.).

Among the medicinal plants which grow wild in England and which are, or might be, collected the writer mentions the following:

- Barberry (*Berberis vulgaris* L.).
- Bittersweet (*Solanum Dulcamara* L.).
- Broom (*Cytisus scoparius* L.).
- Buckbean (*Menyanthes trifoliata* L.).
- Burdock (*Arctium Lappa* L.).
- Centaury (*Erythraea Centaurium* Pers.).
- Coltsfoot (*Tussilago Farfara* L.).
- Elder (*Sambucus nigra* L.).
- Figwort (*Scrophularia nodosa* L.).
- Hemlock (*Conium maculatum* L.).
- Horehound (*Marrubium vulgare* L.).

Male Fern (*Aspidium Filix-Mas* Sw.), a very common fern in moist sheltered stations; hitherto Germany (Harz and Thuringia) supplied all the male fern rhizome or extract used in England.

Meadow Saffron (*Colchicum autumnale* L.).

Meadowsweet (*Spiraea Ulmaria* L.).

Mullein (*Verbascum Thapsus* L.).

Red Poppy (*Papaver Rhoeas* L.), the petals of which find a steady, if limited market.

Sweet Flag (*Acorus Calamus* L.).

Yarrow (*Achillea Millefolium* L.), etc.

Other medicinal herbs, such as squirting cucumber and *Lactuca virosa*, are cultivated in a small way.

A bibliography of 20 works is given as an appendix to the paper.

1010 - **New Garden Plants of the Year 1913.** — Royal Botanic Gardens, Kew, Bulletin of Miscellaneous Information, Appendix III. - 1914. 86 pp. London, 1914.

MARKET
GARDENING

The number of garden plants described yearly is so considerable that it has been thought desirable to publish a complete list of them in the Kew Bulletins each year. The present list comprises all the new introductions recorded during 1913. It includes not only plants brought into cultivation for the first time during 1913, but also the most noteworthy of those which have been re-introduced after being lost from cultivation, and new hybrids. The list contains 454 plants. Of each species or variety the description is given and the publication from which the description is drawn.

1011 - **Pruning Hardy Shrubs.** — BECKETT, E., in *The Journal of the Royal Horticultural Society*, Vol. XI, Part I, pp. 24-34 + 8 figs. London, August 1914.

The growing of ornamental shrubs has developed greatly in the United Kingdom during the last 20 years and a great number of new species have been introduced from the Far East; most of them prove hardy and adapt themselves well to their new home.

The question of the most suitable pruning is very important in order to ensure their maximum ornamental effect. The writer bases the following advice on his own long experience :

Shrubs that require but little pruning, except to keep them in a shapely condition, are: *Arbutus Unedo*, which however, if it has been allowed to grow straggling, can be safely cut back to within 2 or 3 feet of the ground; *Aristotelia Macqui*; *Garrya elliptica*; *Escallonia* spp.; *Cassinia fulvida* (*Diplopappus chrysophyllis*) which much resents being cut into the hard wood; *Cotoneaster* spp., especially the new varieties introduced from China, while some of the older and more common varieties, for example *Simonsii* and *microphylla*, may be cut to within a few inches of the ground if necessary; *Cytisus* spp., which suffer much when cut back into old, hard wood; *Hymenanthera crassifolia*, to be pruned in spring; *Baccharis patagonica* and *B. halimifolia*; most varieties of *Ilex* require to be pruned in July; many of the newer forms of *Viburnum* (while *V. Tinus* answers well when severely cut into the old wood); *Calycanthus floridus*, *C. glaucus* and *Chimonanthus*

fragrans should always be pruned immediately after flowering; *Hamamelis*, which require very little pruning and that when necessary should be done after flowering; *Paeonia Moutan*, the chief pruning they require is to prevent the stocks on which they are generally grafted getting the better of the variety; *Abelias*, *Myrica Gale* (in early spring); *Exochorda* (directly after flowering); *Diervilla* or *Weigelas* (as soon as flowering is over); *Cydonia japonica* *genista*; *Clerodendron tricholomum*; *Coronilla Emerus*; *Hippophae rhamnoides*; *Hydrangea*; *Rhodotyphus kerrioides*; *Potentillas*; *Rhammus*; *Spiraea discolor*, *S. arguta*, *S. bracteata*, *S. media*, *S. Henryi*, *S. Thunbergii*, and *S. Wilsonii*; the various species of *Syringa*, which succeed better on their own roots than grafted on *S. vulgaris*; they should be pruned immediately after flowering; *Ericas*; *Azaleas*; *Rhododendrons*, *Junipers*, etc.

The following require light pruning while they are young, answer well to the knife when adult and when they are old may be cut down to the ground: *Aucuba japonica* and its varieties, the different kinds of *Phillyrea*, etc.

Other plants that answer well to pruning, even if it be severe are: the various species of *Berberis*, some of which, *B. japonica* for instance, may be cut down to the ground when on growing old they become unsightly; it is a mistake to graft the newer choice species from China on *B. vulgaris*; as the greatest possible care is needed to prevent the stock outgrowing the variety; the arborescent forms of *Hedera Helix*; *Ulex europaea*, *Corylopsis*; *Hypericum* spp. which usually require only light pruning; *Philadelphus*; *Ceanothus*; *Stephanandra Tanakae* and *S. flexuosa*; *Thuja gigantea*; *Taxus baccata*, etc.

The following require severe pruning: *Bupleurum fruticosum* (every year in March) the bushy *Loniceras*, which must be pruned after flowering; most of the species of *Ligustrum*; *Buddleia* (second week in April); *Caryopteris Mastracanthus*; *Leycesteria formosa*; *Amorpha canescens*, *A. fruticosa*; *Forsythia* (after flowering); the various species of *Cornus*, especially *C. alba*, which should be cut down to the ground every year in the first week of April; *Sambucus*; *Spiraea japonica*, *S. Douglasii*, *S. hypericifolia*, *S. salicifolia*, *S. chamaedrifolia* (during the winter months), *S. arborea*, *S. Lindleyana*, *S. sorbifolia* and *S. Aitchsoni* (require pretty severe pruning about the last week of March); *Rhus* (never before the first week of April); *Salix*, (in the first week of March); *Symphoricarpos racemosus* (which has to be cut down to the ground every year); *S. orbiculatus* about every seven years; *Tamarix*, which should be cut to within two or three inches of the base of the previous year's growth; the majority of the climbers, such as *Lonicera*, *Polygonum*, *Vitis* and *Wistaria*.

Rumania is on the northern limit for the cultivation of the vine. Since the vine is more affected by cold damp summers than by severe winters, the dry warm summers of Rumania enable this crop to be grown successfully in spite of the rigorous winter.

The best lands for vine growing in this country are those situated at an altitude of 150 to 400 m. (500 to 1300 ft.). The nature of the soil enables vines to be planted in all districts within the above altitudes with the exception perhaps of the extreme northern districts of Botoshani and Dorohoi.

The area of land under vines in 1882 was 287 075 acres, but owing to the ravages of phylloxera it had decreased to 222 467 acres in 1913. The reconstitution of the destroyed vineyards with American stocks was begun in 1893. This work progresses slowly but surely, the area under American stocks having increased from 338 acres in 1893 to 25 403 acres in 1913.

According to the statistics of the Ministry of Lands, the distribution of the vineyards in 1913 was as follows :

		acres
In bearing	Native	112 195
	American	67 173
Reconstituted but not yet in bearing	Native	13 062
	American	30 037
Total		222 467

Although the area occupied by vines only represents 0.69 per cent. of the total area of the country, the vine is of the greatest economic importance to Rumania, for with an average yield of 175 gallons per acre and an average price of 1s 4d per gallon, the gross returns are about £. 12 per acre, apart from the value of the residues.

The statistics of the number of vine-growers, grouped according to the area of their vineyards, show that 95 per cent. of them do not possess more than 1 hectare (2 ½ acres) of vines. The largest extents of vineyards are found in the following districts :

	acres
Putna	34 601
R. Sarat	21 155
Prahova	13 747
Valcea	13 720
Buzeu	12 894
Dolj	10 787
Tecuci	10 218

From the point of view of quality, the vineyards of Cotnari give white wines very much appreciated, but this region is to-day entirely infested by phylloxera and in course of replanting.

On account of the rigorous climate the vines are covered with soil during the winter, after the pruning, except when this is postponed till spring owing to cold weather setting in early ; in this case the vines are simply tipped before burial. They are unearthed during the last weeks of March and begin to shoot early in April in the south, a fortnight later in the north.

The varieties planted are either old native sorts grafted on American stocks, or foreign vines. The choice of varieties has not always been made

prudently or competently. The most important native varieties are as follows:

White: Grasa (Cotnari region), Feteasca Galbena (Odobeshti), Cramposhia (Dragashani), Gardanul (Dragashani), Gordinul (Dealul Mare).

Red: Babeasca (Nicoreshti), Brgahina (Dragashani), Roshu Vartos and Roshu Moale (throughout the country).

The most common foreign varieties are:

French: Cabernet, Malbec, Sauvignon, Cinsaut, Clairette, Pinot, Aligoté, Gamay, Aramon, Carignan, Muscat, Alicante, Bouschet, Colombaud.

German: Riesling.

Austro-Hungarian: Sylvaner, Veltliner, Kadárka.

Wine making is still in a primitive state, owing to the number of small growers who cannot afford the expense of modern apparatus. In 1913 Rumania produced, from the 179 368 acres of vines in bearing, 33 515 430 gallons of wine, valued at £2 188 250. According to the statistics of the Ministry of Industry and Commerce, the movement of wines in 1911 was:

		gallons	£	s
Imports	In bottle	14 831	4 547	18
	Otherwise	132 131	28 599	16
Total . . .		146 962	£33 147	14
Exports	In bottle	625	191	14
	Otherwise	3 620	197	16
Total . . .		4 245	£389	10

Experiments on the production of sparkling wines are very numerous at the present time, but the future of such wines is still doubtful.

FORESTRY

1013 - **The Resin Pine of Tonking.** — CARRIÈRE (Inspector of Waters and Forests) in *Gouvernement général de l'Indochine, Bulletin économique de l'Indochine*, Year 17, No 108, pp. 329-335 + 3 figs. Hanoi-Haiphong, May-June 1914.

Pinus Massoniana, which yields more resin with a higher strength of essence than *P. maritima*, abounds in Indo-China, especially in the region of Quang-Yên. Pines also occur in Tran-Ninh, Lang-Bian, in the mountains of Ha-Giang and in Cambodia, especially in the first two regions; but they are not the same species as those in Quang-Yên and may be considered as allied to *P. montana*.

In order to realise the value of this natural wealth, the Forest Department of Tonking has taken over the control of the cutting and instructed the natives in the methods employed with *P. maritima* in the Landes. At the present time some 70 000 pines are being cut in Quang-Yên, and this number may be increased by at least 5000 trees a year for at least 20 years.

The natural regeneration of the *P. Massoniana* forests is rapid and vigorous, and the Forestry Department has undertaken the reafforestation of certain cleared areas. Under average conditions the percentage of trees obtained by sowing in pots is about 20. One tree will yield about

7 lbs. of resin, containing 17 to 22 per cent. of essence. The resin is valued at about 7s 6d per 100 lbs.

There are numerous unproductive areas in the delta region of Tonking that would yield good returns if planted with resin pines. *P. Massoniana* (the variety with needles in pairs) flourishes in Yên-Thê and the province of Thai-Nguyên.

1014 - **The Balsam Fir.** — ZON, R., in *U. S. Department of Agriculture, Bulletin* 55, pp. 68 + 8 figs. + 2 tables. Washington, D. C., 1914.

This monograph on the Balsam fir (*Abies balsamea* Mill.) deals with its distribution, the forest types in which it occurs, its yield of timber, economic importance specially from the point of view of the pulp industry, methods and cost of working, biology, characters of the timber, rate of growth and proposed methods of cultivation.

The total volume of timber in the zone of commercial exploitation is estimated at about 5 billions of board feet, or sufficient to last 30 years at the present rate of consumption.

With the present methods of cutting, the balsam fir gradually predominates over the American red fir (*Picea rubens* Sargent) in mixed plantations (1).

The growth of the balsam fir is more rapid than that of the red fir, but its life cycle is shorter and it reaches maturity earlier. It should be cut at 100 to 125 years, whilst the red fir under natural forest conditions requires 175 to 200 years. The annual growth of the balsam fir varies from 21 to 42 cubic ft. per acre.

The cultivation in small groups is recommended as the best method of management for this fir, and ensures a better proportion of the red fir during the natural regeneration of the forest.

The chief objections to the utilization of the balsam fir in the production of pulp are as follows: 1) the resin present in the wood; 2) the shortness and weakness of the fibre; 3) the inferior yield of cellulose. The first drawback depends more on the manner of treating the wood than on its contents, the balsam fir being one of the rare conifers with a complete absence of resin canals.

1015 - **The Manchurian Timber Industry.** — BISHOP, C. M., in *Daily Consular and Trade Reports*, Year 17, No. 173, pp. 504-506. Washington, July 25, 1914.

The principal forests of North Manchuria are located in the upper valleys of the Sungari, Tumen, Yalu and Ussuri Rivers and the beginning of the Long White Mountain ranges.

Chinese official statistics are so far available for only one of the "Three Eastern Provinces", i. e. Kirin. In this province alone it is estimated that 7 500 000 trees were cut in 3 years (1910-1912), this figure including pine,

(1) The distribution of the Balsam fir extends from Newfoundland to Great Bear Lake in the West and southwards to the uplands of Virginia; the distribution of the red fir is analogous but less determined (Cf. RATTINGER, K. K.: *Die Nadelhölzer der Vereinigten Staaten*. I. Teil: *Die Nadelhölzer, passim*. Wiesbaden, 1910). (Ed.).

cypress, walnut, chestnut, willow and oak. Chinese statistics give a total area of 2 111 square miles of timberland in Kirin Province.

There are two varieties of oak cut in Manchuria, — Mongolian oak (*Quercus mongolica*) and Chinese oak (*Quercus castanifolia* or *sinensis*). The Mongolian oak is met with all over the regions drained by the Amur, Sungari and Ussuri Rivers, and everywhere in South Manchuria, where it reaches a height of 70 feet and a diameter of 2 to 4 feet. The Chinese oak occurs only in North Manchuria and is smaller than the Mongolian, with leaves resembling those of the chestnut.

The granting of timber concessions in North Manchuria is governed by the "Regulations of 20 rules, governing the granting of concessions in national forests in the three Eastern Provinces (Manchuria)", enforced by order No. 21, of the first year of the Republic of China (1912), issued by the Department of Agriculture and Forestry. Concessions are granted only to those possessing citizenship in the Republic; and when a concessionaire desires to transfer or mortgage his certificate to another person, he must first obtain the sanction of the Bureau of Forestry.

Lumber taxes are of two classes: a) Royalty of national forests at the rate of 8 % according to market value, to be used in defraying the expenses in the administration of national forests, and b) Government tax at the rate of 10 % of the market value, and collected by the Department of Finance for the administrative expenses of the Government; c) a local tax may be imposed depending on the size and quality of the timber.

The Russian timber concessionaries, who formerly supplied only the needs of the Chinese Eastern Railway, have begun to receive orders from Europe and England for timber. There were exported to European ports in 1913 via Vladivostok 200 000 cubic feet in round and square logs and boards. It is probable that in the future this timber will be shipped in increasing quantities from Nikolaievsk; but it is doubtful if this export of timber will continue, for as soon as the present plans for the construction of the new railways in Manchuria are put into operation, there will be a greatly increased local demand for timber. Also there is an increased demand for Manchurian timber in China and the Far East generally, since it is valued more highly than Japanese or Korean timber.

According to Chinese customs statistics, about 9 000 000 cubic feet of timber material were exported to Vladivostok and over 3 000 000 in pieces during 1909. An increase in the duty reduced the export to 1 570 000 cubic feet in material and 147 000 in pieces in 1911. Further, a considerable amount of timber in the form of firewood, sleepers, round logs and boards are required in the construction of the Chinese Eastern Railway.

LIVE STOCK AND BREEDING.

Queensland, where it grows throughout the State, though mostly in coastal localities. They ascertained the presence in it of compounds containing hydrocyanic acid. The freshly cut grass (in June of the present year) yielded by maceration with water and distillation 0.92 grain of hydrocyanic acid per pound. The quantity would probably have been still larger if the plant had been cut when in vigorous growth, that is during the summer months. Cases of sickness in horses and sudden mortality of poultry in Queensland runs infested with *Elcusine* are attributable to this plant.

1917 - The Sheep Maggot Fly (*Calliphora rufifacies*) and its Parasite. — FROGGATT, WALTER W. (Government Entomologist), in *The Agricultural Gazette of New South Wales*, Vol. XXV, Part 2, pp. 107-111 + 1 plate. Sydney, February 1914.

In the first records of flies that deposit their eggs on sheep in Australia, the Sheep Maggot Fly was not included among those that bred in the soiled wool of living sheep. Nor was it included among sheep flies in a paper by the author published in 1905. In 1910 he had not yet bred it from the maggots found in soiled wool of New South Wales, though in the West. it was very plentiful about killing yards, freshly skinned sheep and dead animals.

After 1910 it was soon found that the so-called "hairy maggots" were the larvae of this fly and that it also bred in soiled wool. But at that date *Calliphora rufifacies* was not as common as *C. oceaniae* and *C. villosa*, which till then had been the most injurious. This is another case of the adoption of new habits by a previously harmless insect on account of new conditions arising through the presence of strong smelling wool. From the writer's investigations in the northern and western districts of New South Wales and Western Queensland it is evident that this is now the common sheep fly, while the other two species, from which it probably first acquired the habit, have almost disappeared from this great area and do comparatively very little damage.

Lucilia sericata, the sheep maggot fly of Great Britain, lays its eggs on meat and has been a pest chiefly in Ireland and Scotland from a very early date. It is a common meat blowing pest about Sydney and suburbs, but in earlier investigations it had never been noted in the West or North-West, though now well established, and it has been bred from soiled wool. Hitherto it had never been recorded from the wool or wounds on sheep.

In September 1913 the Minister of Agriculture of New South Wales instituted an Experiment Station for the study of Sheep Maggot Flies near Yarrowin, district of Brewarrina, where sheep maggot flies have been a very serious pest for some years. This Station has discovered that an indigenous chalcid parasitizes very actively the larvae of *Calliphora rufifacies*, as well as those of *C. villosa* and *C. oceaniae*, and that it multiplies very rapidly when bred under artificial conditions. It takes about eleven days to develop from the egg to the perfect insect, which is a small wasp one-twelfth of an inch in length.

1018 - **Typhus in Young Pigs in Germany.** — PFEILER and HURLER, in *Mitteilungen des Kaiser Wilhelms Instituts für Landwirtschaft in Bromberg*, Vol. 6, Part 4, pp. 261-283. Berlin, March 1914.

This paper contains many bacteriological, pathological and anatomical data on the typhus of young pigs and on its diffusion in the German Empire.

So far as it has been studied by the writers in many localities, it is easy to recognize by anatomical examination.

The disease is undoubtedly very widely spread and it has been found by the writers once or more in the provinces of Brandenburg, Hanover, East Prussia, West Prussia, Pomerania, Posen, the Grandduchy of Mecklenburg and in Alsace and Lorraine. Altogether in the course of two years the dangerous disease was observed by them in upwards of a hundred young pigs in twenty-two herds. The writers are convinced that if other countries also were to pay more attention than they have hitherto given to this disease it would be found to be no less frequent abroad than in Germany.

From the point of view of its epidemic character the disease should be considered as important as swine fever. Economically also, owing to the great mortality which it causes, it should command the greatest attention. Of the cases observed by the writers 78 per cent were fatal. According to the information given by the owners in whose herds the disease was rife, it caused a loss of from 25 to 50 per cent. According to other informants the mortality was valued at 60 per cent. Anyhow, where the disease appears pig breeding and its profits are seriously endangered.

In order to check the spread of the disease, veterinary police regulations would be useful; practically it can be successfully controlled by the vaccination of all young pigs.

1019 - **Control of Cattle Ticks and of the Diseases Spread by them (1).** — BRÜNNICH, J. C. and SMITH, F. Factors Influencing Efficacy and Deterioration of Cattle-dipping Fluids, in *Queensland Agricultural Journal*, Vol. II, Part I, pp. 81-92. Brisbane, July 1914. — II. THEILER, A., Arsenic Dips and their Use in the Control of Ticks and of the Diseases Spread by them in South Africa, in *Zeitschrift für Infektionskrankheiten, parasitäre Krankheiten und Hygiene der Haustiere*, Vol. 16, Part 1-2, pp. 1-26. Berlin, September 12, 1914.

I. — A series of experiments was undertaken to investigate the mode of action in the extermination of cattle ticks by means of dipping fluids. Two steers were sprayed with an arsenic dipping fluid (Queensland Government formula) to avoid accidental swallowing. Blood drawn before and after the spraying showed that the effect of the dip on the animal was to increase the arsenic content of the blood during the twenty-four hours immediately following the application of the dip. Two infected heifers were then treated, on small areas of the skin, as follows.

A) Ticks were painted carefully with dipping fluid without wetting the skin of the host.

(1) See also: *B.* 1911, Nos. 2198, 2425, 2753; *B.* 1912, Nos. 146, 358, 359, 810, 934; *B.* 1913, Nos. 42, 43, 691, 815, 1264. (Ed.).

- B) The skin of the host was wetted without wetting the ticks.
- C) Small quantities of the dip (5 cc.) were injected subcutaneously.
- D) Larger areas of skin with ticks were thoroughly wetted with dipping fluid.

Only D proved an effective method of destroying ticks, though some of the ticks in trials A and C appeared to sicken. These experiments, together with the fact that the ticks on small areas which escape wetting in ordinary dipping operations (such as the head) do not die, led the writers to conclude that when an arsenic dip of minimum concentration is used, the death of the ticks within a few days is due to the combined effect of a) absorption of the poison through the skin of the tick after dipping, and b) absorption of the poison by the skin of the animal from which it is subsequently sucked by the tick.

The efficacy of any dipping fluid depends largely on its power of thoroughly wetting the skin of host and tick, leaving a uniform thin film of liquid, *i. e.* on its degree of emulsification. In order to determine the emulsifying power of certain agents, a series of experiments was carried out in which the surface tension of solutions of different recognised or supposed emulsifiants was determined by observing the number of drops formed when a measured quantity of liquid was allowed to run through a fine opening. The result showed the superiority of oleic over the stearic acid soaps, while Stockholm tar also proved very satisfactory; the good qualities of the latter product and of the oleic acid soaps were not diminished by use with acid arsenite as recommended in the Government formula. Further, Stockholm tar did not lose its emulsifying power to the same extent as other emulsifying agents when the dip was made up with hard water, and for that reason should be a valuable ingredient in dipping fluids.

The conversion of arsenite to arsenate on keeping was also investigated. This process had occurred in about 25 per cent. of the dips examined during the three previous years; it decreases the value of the dip, as the tick-killing property of the arsenate is only about half that of the arsenite. A series of tests was made, in which a) pure arsenite solution, and b) an arsenite solution containing tar and soap and approximating to the Government formula, received a small amount of nutritive material, were sterilized, inoculated with oxidised dipping fluid and incubated under various conditions of illumination. The results were as follows:

1. Pure arsenite solutions under sterile conditions remained unoxidised in darkness or in diffused light, but underwent marked oxidation in direct sunlight.
2. In the presence of tar, sterile arsenite solutions underwent marked oxidation in darkness; in diffused light and direct sunlight the oxidation was still more marked.
3. The oxidation of arsenious to arsenic acid was also effected by bacterial agency; the oxidising bacteria seemed to be equally active both in light and in darkness, but there appeared to be a marked difference in the activity of different strains of organisms.

4. Tar, apart from its effect in itself inducing^{*} oxidation, appeared to exert an inhibitive effect on the activity of oxidising bacteria, and this inhibitive effect seemed to be exerted to a greater extent in sunlight, direct sunlight in tar solution almost completely preventing the activity of certain strains of bacteria.

5. Bactericides, such as mercuric cyanide and formalin, were effective in preventing growth of oxidising organisms, and bacterial activity was necessarily not evident except in presence of nutritive material.

In the 75 per cent. of cases in which oxidation does not occur in dipping fluids, it has been suggested that the apparent inhibition is due to the agency of organisms capable of reducing arsenic to arsenious acid. In order to test this point, sterile arsenate solutions, with and without tar and soap, provided with nutritive material and equivalent to 0.2 per cent. As_2O_5 , were inoculated with various media likely to gain access to dipping fluids in dipping practice (dung, soil, grass, etc.); they were maintained under conditions of light and complete darkness during periods of two and four weeks, when they were examined for arsenic in the reduced form of arsenite. Reduction was found to have taken place in all cases where tar and soap were present, but only in a few cases where tar and soap were absent; it would thus appear that the tar has a less well marked inhibitive effect on reducing than on oxidising bacteria and that the former only gain the upper hand when the latter have been weakened. The maintenance of the arsenite concentration of dipping fluids would therefore seem to rest mainly on the growth and activity of organisms capable of preserving it in opposition to the oxidising influence of tar, light and the opposing oxidising bacteria; the determination of the environmental conditions most conducive to their multiplication presents the most promising field for further investigation.

For the present the recommendations for cleaning out dips, when the dipping-fluids show persistent rapid oxidation, are to empty and cleanse thoroughly, spray walls, woodwork and dripping yards with formalin solution, whitewash dip and timber, and allow at least a week's interval before recharging.

II. — In South Africa the most dangerous cattle disease of recent years is the East Coast fever caused by a blood parasite, *Theileria parva*, which was introduced in 1902 from German East Africa. This parasite develops in the lymphatic organs, whence, on attaining maturity, it passes into the blood corpuscles. According to the writer the disease is spread by ticks, especially by the brown tick (*Rhipicephalus appendiculatus*) which has three hosts, and the red tick (*R. evertsi*) with two hosts; but the black tick (*R. Simus*) and the blue tick (*Boophilus decoloratus*) may also be considered as carriers of the disease. The writer gives a short description of the life history of each of these ticks.

For the prevention and cure of the disease, the first thing is the destruction of the ticks, but it took a considerable time for this desideratum to be adopted in practice. An impulse in this direction was given by the steady spread of the Coast fever in Natal, where the measures successfully

adopted in the Transvaal were of no avail. At first it was tried to dip the animals once every four weeks in an arsenical fluid, but as no effect followed, the interval between the successive dips was shortened to three, two and one week, without however obtaining any better results. Whereupon PITCHFORD experimented in Natal with dips repeated every five and then every three days and found that with three-day intervals the disease could be stopped. The efficacy of the latter method lies in the fact that infection in cattle sets in between 60 and 120 hours after the ticks have fastened on to their hosts.

The composition of the dip originally recommended by PITCHFORD was 8 $\frac{1}{2}$ lbs. sodium arsenite, 5 $\frac{1}{2}$ lbs. soft soap, 2 gallons petroleum and 400 gals. water. It was later discovered that the dip was more efficient without petroleum or soap.

For dips repeated at short intervals, farmers in South Africa use commonly 4 to 4 $\frac{1}{2}$ lbs. of the arsenic salt to 400 gallons of water. When the animals are dipped at longer intervals the proportion of arsenic is correspondingly increased.

On the occurrence of an outbreak of the disease dipping must be continued until the ticks living in the grass have been starved to death this may require as much as 14 months. As a general rule all the animals that are out grazing must be dipped, including pregnant cows and calves. Horses, sheep and pigs are not so frequently dipped as cattle. The average time required for each animal does not exceed 6 seconds.

As secondary effects of these dips, a temporary diminution of the milk yield of the cows and of the capacity for work of the oxen are generally noted in South Africa, but no cases of poisoning through drinking the arsenical liquid while dipping have been observed.

The ticks begin to diminish after the first dip; the first to die are those that are not fully gorged, the last the fully gorged ones. The parts of the body that are first freed from the ticks are the udder, the insides of the bhigs and the barrel. The most easily destroyed ticks are the one-host blue ticks, the most difficult to eradicate are the two-host red ones. Besides Coast fever, all the other diseases which are spread by ticks in South Africa, such as Texas fever, anaplasmosis and the like, are controlled wherever arsenic dips are practised. Besides which, in many localities, the mortality among calves has been considerably reduced. The disappearance of white scour in calves and of a contagious inflammation of the eyes in cattle caused by *Filaria lacrymalis* wherever arsenic dips have been used, has been remarkable.

The only drawback that can be mentioned in connection with these dips is that the young animals can no longer be immunized against Texas fever and anaplasmosis.

The writer concludes with the observation that the use of arsenic dips in South Africa has solved at one stroke the problem of the prevention and cure of all diseases transmitted by ticks.

ANATOMY
AND
PHYSIOLOGY

- 1020 - The Effect on the Milk Glands of Volatile Fatty Acids from the Food. — BEGER, C. in *Die landwirtschaftlichen Versuchs-Stationen*, Vol. 85, Part 1-2, pp. 155-163. Berlin, August 3, 1914.

The writer gave alternately to two goats, together with a certain basal ration, first an oil having a very high Reichert-Meissl value (guinea-pig cheek oil) and then one with a very low R. M. value (earthnut oil) and observed to what extent the addition of volatile fatty acids to the fodder acted upon the R. M. value of the butterfat and generally upon lactation.

The two animals experimented upon were of the same breed and in an advanced period of lactation. The experiments showed that the addition of volatile fatty acids to the fodder had no sensible effect upon the R. M. value of the butterfat, but that it had a stimulating effect upon the absolute quantity of milk and upon its composition.

Though the guinea-pig cheek oil is a fat which owing to its specific characters (it consists chiefly of valerianic acid) does not pass directly into the milk glands and thence into the milk fat, it must contain other substances similar to the components of milk which act favourably on the nutrition of the milk glands. It can consequently be assumed that in the fat contained in food there are substances which can act as stimulants upon the milk glands independently of their nutritive value.

According to the writer the composition of the milk fat seems to be influenced only by such components of the fat in the food as already exist in the milk. The milk glands have the power of rejecting those substances which do not already exist in the milk or of utilizing them only under quite special conditions. In consequence of this fact the writer does not think that experiments with iodized or coloured fats made with the object of determining the passage of fats contained in the food into the milk can give conclusive results. The udder decomposes the available material and then selects among these components. The loosely combined iodine and similar substances are probably first separated, after which they act as if they had not been joined to the fat.

FEEDS
AND FEEDING

- 1021 - The Presence of Arsenic and Manganese in some Feeding Stuffs. — JADEN, F., and ASTRUC, A., in *Comptes Rendus hebdomadaires des Séances de l'Académie des Sciences*, Vol. 159, No. 3, pp. 268-270. Paris, July 20, 1914.

The presence of minute quantities of arsenic and manganese in animal tissues has previously been recorded. The same fact has now been proved in the case of vegetable tissues. In order to show the source of supply of the arsenic and manganese in animals, the writers have determined their presence and percentage in the more common feeding stuffs. The results are shown in the accompanying table.

Forage.	Composition		Manganese		Arsenic
	Water	Ash	Mgms. per 100 gms. of dry matter	Mgms. per 100 gms. of ash	Mgms. per 100 gms. of dry matter
<i>Medicago sativa</i>	64.00	3.35	5.00	53.73	0.050
<i>Hedysarum humile</i>	73.50	2.00	4.33	57.50	0.056
<i>Vicia sativa</i>	62.90	4.75	2.68	21.05	0.054
<i>Trifolium pratense</i>	67.50	3.55	5.38	49.29	0.037
<i>Solanum tuberosum</i>	74.46	0.85	0.14	4.23	0.031
<i>Beta vulgaris</i>	91.83	1.16	1.63	11.43	0.061
<i>Populus nigra</i>	64.20	2.48	17.46	322.58	0.019
<i>Castanea vulgaris</i>	55.45	1.00	1.56	140.00	0.011
<i>Oryza sativa</i>	13.66	1.11	0.93	72.00	0.008
<i>Zea Mays</i> (seed)	17.65	1.52	1.94	105.26	0.036
<i>Zea Mays</i> (stems and leaves) . .	85.50	1.45	4.13	41.37	0.027
<i>Hordeum distichum</i>	10.06	2.60	3.78	130.76	0.055
<i>Avena sativa</i>	19.66	2.99	4.97	133.77	0.062
Bran	17.20	4.74	8.59	150.21	0.012
Grass (1)	52.75	6.80	16.93	117.64	0.053

(1) Consisting of 96.98 per cent. Gramineae, the species present being: *Anthoxanthum odoratum*, *Holcus mollis*, *Agrostis canina*, *Lolium perenne*, *Ranunculus acris*, *Cerastium brachypetalum*, *Linum angustifolium*, *Trifolium minus*.

1022 — The Bacterial Flora of Some Fresh or Fermenting Concentrated Foods and its Effect on Milk. — WIGGER, A., in *Centralblatt für Bakteriologie, Parasitenkunde und Infektionskrankheiten*, Vol. 41, No. 1-8, pp. 1-227. Jena, May 27, 1914.

The three concentrated foods most frequently used in Switzerland, namely bran, earthenut meal or cake, and sesame meal or cake, were examined. The fodder containing the highest number of germs was bran, which, as an average of 15 samples, contained 6 million germs per gram. Earthenut meal and cake contained, as an average of 18 samples, 1 $\frac{1}{4}$ million. Sesame meal and cake, average of 24 samples, contained about $\frac{1}{2}$ a million per gram.

Pollards were by 57.5 per cent. richer in germs than bran. Earthenut cake contained more of them than the meal, while, with sesame no difference in this respect was found to exist between the cake and the meal. The variation in the germ content of the individual fresh samples was relatively greatest in bran and smallest in sesame.

The bacteria in the fresh sesame and earthenut foods are much the same, and much richer in species than in bran. The latter contained 21 different species of schizomycetes, earthenut concentrates 44, and sesame 48. As typical species in bran the writer found: *Bact. coli*, var. *intestinalis* Lehmann and Levy, yellow acid producers Levy (1), *Bact. herbi-*

(1) Not yet named in Latin.

(Ed.).

cola aureum Burri and Duggeli, and *B. fluorescens liquefaciens* Lehmann and Neumann. The earthnut foods contained in prevalence *Bact. mesentericum vulgatus* Flügge, *B. subtilis* Cohen, *B. coli* var. *luteoliquefaciens* L. and L., yellow acid producer Levy, and gas-forming lactic acid bacteria. As typical sesame bacteria the following were found: *Bact. mesentericum vulgatus* Flügge, *B. subtilis* Colon, *B. coli* var. *luteoliquefaciens* L. and L., yellow acid producers, gas producers and cocci.

In moistened concentrates the number of germs increases to an extraordinary degree and at 37° C. after 24 hours reaches its maximum, after which it sinks. During this time there is such a constant change in the nature of the flora that the fermentation may be considered as a metabolic process. The changes thus brought about are, during the first days, principally a lactic acid fermentation; later more mixed fermentations prevail. The former was more clearly visible in the earthnut foods and less so in the sesame. Fluorescent bacteria are fairly common in both.

The typical bacterium of putrefaction, *Bact. putrificus coli*, is especially abundant in earthnut meal and cake (in 55 per cent. of the samples), in bran rarer. Through the multiplication of these bacteria, the concentrated food can undergo such changes that animals refuse to eat it, or if it is eaten it produces symptoms of poisoning, as the writer proved by examples. He has found in bran also the virulent bacillus of anthrax, as he was able to demonstrate experimentally on animals. Thus the sudden unexpected breaking out of anthrax may be explained in many cases.

As for the influence of these feeds, fresh or fermented, on the bacterial contents of milk, the writer says that small contaminations with them at normal temperatures have no noticeable effect upon the fermentation of milk, but at higher temperatures, 37° C. (98.6° F.), changes in the milk and the evolution of gas are accelerated. In dirty milk or in ordinary somewhat older milk, small additions of these concentrates do not cause noticeable differences in the bacterial content, while in sterilized milk the changes brought about by such additions are somewhat more marked.

1023 - The Food Value of the Jack Bean (*Canavalia ensiformis*) (1). — BARNSTEIN, F., in *Die landwirtschaftlichen Versuchsstationen*, Vol. 85, Part 1-2, pp. 113-122. Berlin, August 3, 1914.

The Jack bean (*Canavalia ensiformis*) is a leguminous plant cultivated in German East Africa and in many other tropical countries and distinguished by its abundant yield and great resistance. On account of its abundant yield attempts have been made in German East Africa to utilize the seeds in the country itself and also to export them.

Notwithstanding that a certain quantity of these beans are exported to Hamburg, their sale abroad has not hitherto amounted to much.

The chief obstacles to their utilization in the German East African protectorate are that the natives, not knowing the plant, are not inclined to eat the seeds, and that it is not yet well known whether the beans are poisonous, as is believed in many localities, or not. If they are found

(1) See also No. 498, *B. May* 1913.

(Ed.).

to be harmless, they may be of considerable importance as a feedingstuff, since they are very rich in nutritive material.

Chemical analyses of Jack beans were carried out by BONAME in 1911, and they give the following composition for seeds and pods:

	Seeds percentage	Pods
Water.	13	15.2
Protein	25.62	5
Fat.	2.32	0.64
Crude fibre	7.9	57.91
N-free extract	47.94	15.47
Ash.	3.22	5.78

According to a recent analysis by the writer the seed in its original condition contains:

Water.	13.16 per cent.
Crude protein	31.51 "
Pure protein	24.82 "
Fat	2.18 "
N-free extract	41.90 "
Crude fibre.	8.59 "
Ash	2.47 "

The digestibility of the beans as it resulted from a four-weeks test carried out by the writer on two young sheep was as follows:

Dry matter	87.5 per cent.
Organic matter	88.6 "
Crude protein.	80.5 "
Crude fat	72.1 "
N-free extract	99.1 "
Crude fibre.	72.9 "

With these coefficients of digestibility, the starch value works out at 63.7 per cent., with 18.69 digestible pure protein. The jack bean stands thus, as regards its nutritive value, somewhat lower than the common field bean, which according to Kellner has a starch value of 66.6 per cent. and 19.3 per cent. digestible pure protein.

During the experiment the animals were given the relatively high ration of 0.44 lb. of crushed beans, without apparently suffering any ill effects. Of course it would be premature to draw the conclusion that these beans, under all conditions, are a harmless fodder and it would be advisable to repeat the experiments.

102.4 - **Has the Dry Matter in the Various Root Crops the Same Food Value? —**
HANSSON, NILS, in *Mitteilungen der Zentralanstalt für das landwirtschaftliche Versuchswesen in Schweden*, pp. 11-12. Stockholm, 1914.

During the winter half-years 1908-09 and 1909-10 exhaustive feeding experiments were carried out with the object of determining whether the current assumption that the dry matter in the various root crops has the same value is correct or not. Thirty milch-cows were used, and divi-

ded into five equal groups. In the preparatory period they were all fed 66 lbs. of Bortfeld turnips per diem. During the time that the experiment proper lasted, about $1\frac{1}{2}$ months, one group continued to be fed with the usual turnips, and the other groups were given other roots containing the same amount of dry matter. The rations of the various groups per head and per day were as follows :

Group	I	66	lbs. Bortfeld turnips
	II	36.70	» Saruuner »
	III	33.66	» Hellrothe Flasche mangolds
	IV	40.04	» Swedes
	V	41.80	» Eckendorf mangolds

Owing to the different content of dry matter, the quantity of roots fed varied, the dry matter in all cases being 5.28 lbs. per head per day.

The experiment showed that the substitution of one root for another did not cause any appreciable difference in the milk yield nor in its fat content. The live weight of the cows was also not affected. The conclusion can thus be drawn that the dry matter in the various roots has practically the same food value.

1025 - **Common Salt as a Poison for Stock.** — GUTHRIE, F. R., in *The Agricultural Gazette of New South Wales*, Vol. XXV, Part 8, pp. 663-664. Sydney, August 3, 1914.

Although a certain amount of salt is a necessary adjunct to the food of animals, an excessive quantity is injurious.

In the case of pigs and sheep, 4 to 8 ounces is said to have produced poisoning (see LANDER, *Veterinary Toxicology*, 1912). In larger quantities it has proved fatal to horses and even to cattle. Fowls would appear to be particularly susceptible. According to experiments conducted by LUFFRAN, 4 grams per kilo live weight are fatal if injected in solution into the crop. Recently several instances have been brought under the notice of the Department of Agriculture of New South Wales, in which the deaths of poultry and pigs have been traced to an excessive amount of salt in the food. In a fowl which had died suddenly, the contents of the crop weighed 50 gms. and were found to contain 2.42 gms. of salt, or 4.84 per cent.

The Department therefore warns farmers of the necessity of care in using certain foods found on the market. One sample of pollard was discovered to contain no less than 32.2 per cent. by weight of common salt. Other samples contained varying amounts down to 5.8 per cent. One case of poisoning of pigs was reported, and it was found that the food supplied to them was a mixture of pollard, barley meal and 11.66 per cent. of salt.

The toxic effect of salt appears to be due to its action on the muscles, so that the animal becomes unable to walk and, finally, to stand. Death is caused by asphyxia, due to loss of power in the respiratory muscles.

1026 - Scale of Points for Judging a mixed Dairy Farm. — *The Agricultural Gazette of New South Wales*, Vol. XXV, Part 2, p. 106. Sydney, February 1914.

An Agricultural Association wrote to the Department of Agriculture of New South Wales asking for a scale of points suitable for a competition of farms including dairying. Two experts of the Department compiled the following classification :

STOCK RAISING:
ORGANIZATION
AND
ENCOURAGE-
MENT

A. Management :	Points
1. Checking production and quality of dairy produce and the working of dairy machinery	25
2. Supervising, feeding and watering of stock ; making provision of fodder and pastures (calf feeding methods to have special attention)	30
3. Attention to breeding with a view to improving yields and supply of heifers for the future ; supervising with a view to disease prevention in calves, cows, etc.	35
4. Book-keeping and milk record keeping ; stud books for cattle and pigs	10
	100
B. Stock :	
1. Cattle, quality and type, taking into consideration the character of land and purposes for which cattle are used, viz. cheese, butter or town milk supply. Milk and butter yields to be taken into account	100
2. Pigs	30
3. Horses	15
4. Poultry	5
	150
C. Crops, including rotation, cultivation methods and manuring :	
1. Most suitable fodder crops for dairy cattle	15
2. Other crops	15
3. Yield	15
4. System of cultivation, including manuring methods, rotation and cleanliness of crop	15
5. Freedom from disease in crop	8
6. Trueness to type	7
	75
D. Pastures :	
1. Improvement of pastures ; most suitable grasses, sown according to locality ; grass experiment plots	50
2. Subdivision into most suitable paddocks	25
	75
E. Buildings and Fences :	
1. Dairy and bails	18
2. Homestead	12
3. Piggery and poultry farm	10
4. Fences and gates	10
	50
F. Machinery and Tools	50
Grand Total	500 points

1027 - Some Data on the Animal Products and the Control of Rabbits in New South Wales, 1913. — JACKSON, H. V., in *The Agricultural Gazette of New South Wales*, Vol. XXV, Part 6, pp. 504-506. Sydney, June 1914.

During the year ending 31st December 1913 the value of the animal products exported from New South Wales was as follows :

	£
Wool	11 699 858
Meats: Beef	247 934
Mutton and Lamb	1 215 878
Rabbits and Hares	373 633
Preserved	575 855
Tallow	1 002 076
Skins: Hides	910 609
Sheep	439 525
Rabbit and Hare	310 694
Other	612 812
Leather	369 210
Butter	988 143
Live animals	54 098

The number of rabbits exported was 13 556 160 head; the hares 325 770.

The number of poultry on farms of 1 acre and upwards, at the end of 1912, was 3 351 000 fowls, 261 100 ducks, 23 900 geese, 216 300 turkeys, 6000 other birds. The estimated number of eggs obtained during the year was 13 769 000 dozen. During the season 1913-14, 476 312 dozen eggs were held in cool stores. In addition there were also stored 9 802 tins of pulped eggs of 40 dozen each.

CATTLE

1028 - Comparison between the Observed and Calculated Production of Heat in Cattle. — PRENTISS, ARMSBY HENRY, in *Landwirtschaftliche Jahrbücher*, Vol. 46, Part 5, pp. 753-759. Berlin July 14, 1914.

After a review of the experiments of RUBNER, LAULANIE, ATWATER and BENEDICT, and BENEDICT and MILNER, all of whom have shown that the relations between chemical, thermic and mechanical energy are the same in man and in carnivora as everywhere in nature, the writer reports upon his own experiments on herbivorous animals, which have been carried out as usual by measuring the production of heat by means of a respiratory calorimeter (Atwater-Rosa system) and then comparing the results with the production of heat calculated from the balance of the nutritive elements. Altogether 57 experiments with oxen, nearly or quite mature, have been carried out since 1902, the results of which are available for comparison. They show, as was to be expected, that the results of the individual experiments do not always agree perfectly with the requirements of the law on the conservation of energy. The greatest deviations were + 7.6 per cent. and — 5.1 per cent. The average of the 57 experiments, however, shows that the observed production of heat differs from the calculated heat only by 0.4 per cent. This difference is about the same as that found by the above-mentioned observers.

The conclusion is thus justified that in herbivorous animals the same relations between chemical, thermic and mechanical energy exist as in carnivora and in nature generally.

1029 - **Calf Rearing Experiments in Hungary.** — KERÉKES, GÉZA, in *Köstelek*, Year 24, No. 61, pp. 2172-2173. Budapest, August 15, 1914.

These experiments were carried out with 18 calves on the Vitka farm belonging to Count Károlyi. One batch of animals was fed on separated milk, the cream being replaced by rye flour: the writer was led to make this choice on the principle that carbohydrates can take the place of fats in animal nutrition. The flour was given at the rate of first 4 oz., later 5 oz. per gallon of separated milk, the formation of lumps being avoided by vigorous turning in a churn. The emulsion was then warmed to the temperature of the cow's udder.

The 18 calves were divided into two groups, one of which (Group I) was fed naturally, while the other (Group II) received the following treatment during four successive periods: 1) whole milk up to the age of 4 weeks; 2) gradual substitution of whole milk by the emulsion until the quantity of flour reached 5 oz. per gallon at the end of about 8 weeks; 3) milk emulsion with a gradual reduction in the quantity of flour toward the end of the period, *viz.* to about 3 months old; 4) separated milk at the rate of $2\frac{1}{4}$ to $2\frac{1}{2}$ gallons per calf daily. The determination of the rations during the three earlier periods was based on the eighth part of the live-weight of the animals, which were weighed each week.

Table I gives the live-weight of the calves at birth and at 12 weeks. During the 4th period the artificially fed calves continued to drink their daily allowance of separated milk, whilst all except three of the calves of the other group refused to take skimmed milk when taken off whole milk at three months (see Table II).

TABLE I. *Weight of calves at birth and at 3 months (lbs).*

Group II			Group I		
Nos. of calves	Weight at birth	Weight at 3 months	Nos. of calves	Weight at birth	Weight at 3 months
55	73	317	115	70	211
60	75	251	88	75	233
61	77	258	116	77	249
26	79	348	7	82	229
144	79	293	86	86	266
77	84	326	85	88	260
19	86	266	118	88	269
14	86	306	59	88	
12	88	306	198	93	231
Average	80.6	297.5	Average	82.9	248.2

TABLE II. — *Weight of calves at 4 months (lbs.).*

Group I		Group II		Remarks
Nos. of calves	Weight	Nos. of calves	Weight	
55	401	115	253	refused milk
60	353	88	271	"
61	337	116	306	"
26	417	7	287	"
144	375	86	311	"
77	397	85	335	took milk
19	366	118	359	"
14	386	59	353	"
12	390	198	271	refused milk
Average	380.0	Average	305.0	

TABLE III. — *Average weekly rations per calf from the 1st to the 12th week.*

Period	Group I		Group II	
	whole milk — gals.	whole milk — gals.	separated milk — gals.	rye flour — lbs.
1st week	. . . . . Colostrum			
2	7.2	7.2	—	—
3	8.0	8.0	—	—
4	9.2	9.2	—	—
5	10.5	8.8	1.7	0.42
6	13.1	9.9	3.2	1.17
7	14.2	7.9	6.2	1.87
8	15.4	3.1	12.3	3.70
9	16.6	—	16.6	5.00
10	12.5	—	12.5	3.74
11	7.8	—	7.8	2.35
12	4.6	—	4.6	1.14
Totals . . .	119.2	54.2	65.0	19.41

Omitting the cost of hay and oatmeal, which was the same in both groups, the cost of feeding works out as follows:

Whole milk calves:

119 gals. at 1s 1½d per gal. £6 15s

Emulsion calves:

54.2 gals. of whole milk at 1s 1½d	£3	1s	7d
65 " " separated milk at 3.6d		19	8
19.4 lbs of rye flour at 1.1d		1	9
	£4	3s	0d

Thus the difference is £2 12s in favour of artificial feeding.

These figures show a considerable economy.

1030 — **Indian Cattle in the Philippines.** — EDWARDS, C. W., in *The Philippine Agricultural Review*, Vol. VII, No. 7, pp. 288-291 + 2 plates. Manila, July 1914.

The Philippine Archipelago, with its extensive pasture area, abundant water supply and tropical climate, is principally a live-stock country; nevertheless there is a great deficiency of both meat and work stock. This state of things cannot well be remedied by the importation of animals from abroad, as these would be more liable than the native cattle to the diseases that have caused the depletion in numbers. On the other hand the lack of good local breeds is a serious obstacle to the improvement of the native cattle. A considerable amount has been spent in an effort to raise pure-bred European and American cattle and their crosses with the native stock, but, except in a few cases, the attempt to raise pure-breds has failed, and the crosses, while showing good conformation and size, were more susceptible to disease. In fact this has been the general experience throughout the Tropics under natural range conditions. Considerable numbers of cattle have been introduced from tropical China and Indo-China, but they, and especially the former, are susceptible to rinderpest and are not in general as great an improvement as would be desirable, as they are lacking in the prepotency of their characters.

Of recent years Zebus from British India have been imported into the Philippines and successful results have been obtained in breeding both pure-breds and crosses.

Lieut. Col. W. D. Gunn, formerly superintendent of the civil veterinary department, Madras, distinguishes seven principal breeds of Zebu (*Bos indicus*) cattle:

1. Mysore breed or Amrat Mahal.
2. Mahadeswarabetta or Alumbadi.
3. Ongole or Nellore.
4. Kangayan.
5. Pulikolum, Jellicut.
6. Kappliyam.
7. Gumsur.

Of these breeds the most important are the Ongoles and Mysore; the former are particularly noted for their suitability for heavy draught and the latter for their extremely hard feet and aptitude for road work. The Ongole is bred in greatest numbers in the Guntur district, Madras presi-

dency. This breed has been imported into Brazil, Argentina, Java and Africa and a few into the United States, particularly into Texas. It is the only breed with which any definite breeding experiments have been carried on in the Philippines. It has been imported by local dealers and by the Bureau of Agriculture, which experimented with these cattle at the La Carlota station, Occidental Negros Province, at the Trinidad stock farm, Benguet, in the subprovince of Bukidnon, and at Alabang.

The results have been excellent. These animals showed a high resistance or apparent nearly complete immunity to rinderpest, immunity to tick-fever and a resistance to insect pests nearly equal to that of the native animals. In all sections excepting those at high altitudes where the temperature is comparatively low during the rainy season, these animals have exhibited remarkable qualities of thrift and hardiness, superior to those of the native stock; they have proved also successful for road and light field work. Their crosses with the native stock are highly resistant to rinderpest; they are a great improvement in size and conformation over the native dams and exhibit to a great degree most of the desirable characters of their Zebu parents.

In many respects Indian cattle are not to be compared with improved European and American breeds, but they are far better adapted to existing conditions in the Philippines.

1031 - **Rearing Pigs in Movable Pens.** — HVENEGAARD, M., in *Gaceta Rural*, Year 8, No. 85, pp. 37-45 + 9 figs. Buenos Aires, August 1914.

The writer has obtained very good results in the Argentine with a system of rearing pigs in movable pens; he has obtained an average of 12 pigs per sow per annum with a herd of 1000 sows.

The pen measures 9 ft. 9 in. by 6 ft. 6 in. and is 2 ft. 9 in. high; it is made of six 2 in. \times 3 in. uprights to which are nailed four rows of 1 in \times 3 in. bars, 7 $\frac{1}{2}$ in. apart; shelter is provided by a piece of corrugated iron at one end sloping from the top bar to the second bar and by two other pieces fixed to the lower three bars below it. The 7 $\frac{1}{2}$ in. space allows the young pigs to pass to and fro. A trough of 5 gallons capacity is placed in each pen. The cost of such a pen does not exceed 15 pesos (about 26s).

The pens are placed in lucerne fields 20 yds. apart in rows 120 yds. apart. Litters of different ages should not be allowed in the same row, or the bigger ones will enter the pens of the younger and interfere with their sucking. When breeding is carried out all through the year, 100 pens are sufficient for 300 sows. After the pigs are weaned the sows are allowed to pasture with the boar (1 boar for each 25 to 30 sows) and the sows near farrowing are removed to the pens each week.

The pens are moved each day to provide fresh clean pasture; three men can move 100 pens in an hour. Fresh water is supplied each morning and about 7 lbs. of maize is allowed each sow in the afternoon. Weaning takes place at the age of 2 $\frac{1}{2}$ to 3 months, and to simplify the work it is better to wean those of a row at the same time. After weaning the males are castrated, and all are marked and given an insecticidal bath. They are then put out to pasture until 1 year old.

At least one shed 25 yds. \times 6 yds. should be provided for every 1000 pigs to afford them shelter in bad weather. From $\frac{3}{4}$ to 1 lb. of maize per head is allowed daily. At one year old they should weigh about 110 to 150 lbs.; they may then be fattened if desired by turning them into a maize field. With a good crop of maize 250 acres will fatten 1000 pigs in 2 to 4 months. During this period the fattest are chosen and sent to the market. If possible the crops should be arranged so that the lucerne fields surround the maize crop, thus enabling the pigs to prevent an attack of locusts.

The economics of this system under Argentine conditions are as follows (taking the dollar at 1s 9d) :

<i>Capital Expenditure :</i>	£
6 200 acres at about £5 12s	35 000
Buildings, etc.	8 750
1 000 sows at £3 10s	3 500
40 boars at £3 15s	350
First year's expenses	6 562
Total	£ 54 162

<i>Annual Expenditure :</i>	
Interest on capital at 8 %	4 333
Labour; 8 or 10 peons	875
Maize for rearing purposes	3 500
Cultivation of 2 200 acres of maize for fattening	1 312
Sundry expenses	1 355
	£ 11 375

<i>Receipts :</i>	
10 000 pigs, weighing 220 lbs. each	29 875
Profit	£ 17 500

1032 - **Comparative Experiments on Pigs in the State-subsventioned Breeding Districts of Denmark.** — *Eighty-fifth Report of the Royal Veterinary and Agricultural College in Copenhagen.*

In Denmark there are practically only two breeds of pigs : the Danish and the Large White Yorkshire.

The Danish breed, to which by far the majority of the pigs in the country belong, is the most resistant and prolific, and its offspring possess the greatest vitality, but at the slaughterhouse it is inferior to the Large White, which is especially good in this respect. A good breeding animal is produced by crossing the two breeds.

But the greatest efforts are being made to improve the native breed by selection and pure breeding, and encouragement for this is given in various ways, the chief of which is the granting by the State of a moderate yearly sum to owners of herds of pure-bred well built animals who are disposed to breed the pure strains and to place their herds under public control; for this, besides the grant, they get recognition from the State as belonging to a breeding district.

Such districts have been created for natives and for Yorks; in 1914 there were, in Denmark, 83 for the former, from which mostly young sows are sold, and 22 for the latter, which chiefly sell young boars.

In order to obtain abundant data on the development of the breeds and on their qualities, three control and experiment stations for pigs have been founded, where the offspring of the selected breeding animals (the only animals that the breeding district is empowered to sell) are fattened and slaughtered under State control. One of the conditions for the recognition and the grant is that the breeder obliges himself to sell every year two young pigs from each selected sow to the local experiment station at the current market price. A group of young pigs for experiments (4 head) consists, as a rule, of 4 animals of the same litter and when possible of two females and two males.

Every year a Report is issued on the results obtained at the experiment stations; the present is the fifth such Report. The result of the experiments is to the effect that the development of the two breeds is nearly the same, while the local breed is inferior at the slaughterhouse test, especially as regards hams and sides; the Yorks yield about 2 per cent. more bacon for exportation (thus less offal) than the native pig. In both breeds about 1.1 lb. of increase was obtained from $3\frac{3}{4}$ food units. The age of the pigs when slaughtered (weight about 198 lbs.) was on the average barely 200 days.

POULTRY

1933 — **Poultry Conditions in Indiana.** — PHILIPS, A. G. (Division of Poultry, Department of Animal Husbandry) in *Purdue University, Agricultural Experiment Station, Circular No. 40*, pp. 32 + 20 figs. Lafayette, Indiana.

The following figures are taken from the Fourteenth Biennial Report of the Department of Statistics of Indiana for 1911-12, but they do not ever show the whole value of the poultry raised because they do not include the numbers of hens kept inside town and city limits.

No. dozen eggs produced in 1910.	68 672 724
" " " " " 1900.	38 987 348
Increase	29 685 376 or 76 per cent.
1911. — No. poultry sold	7 425 144 value \$ 3 146 143
" laying hens on hand	9 530 220 " " 3 938 933
" ducks, turkeys, geese on hand	209 604 " " 124 973
Total	\$ 7 210 049
No. dozen eggs produced 69 690 104 value	" 13 130 407
Grand total	\$ 20 340 456
Average value per dozen: 18 cents.	
Average egg production per hen: 87.7 eggs.	

Poultry keeping is especially developed in White, Kosciusko, Allen, Adams, Cass, Jay, Randolph, Ripley and Grant counties.

Two thousand lists of questions were sent out in the State by the Purdue University Agricultural Experiment Station and elicited 704 answers. From these it appears that 704 farmers kept 94 589 fowls, or an average of

134.5 per farm; the average value of each bird is 42 cents so that the farmer's average investment in fowls is only \$ 56.49. About one half of the birds are pure bred. For small farms Plymouth Rocks are most popular, while for the larger ones Leghorns seem to be preferred.

From the monthly records submitted to the Poultry Department of the Experiment Station by farmers of the State, it is found that where Leghorns, Plymouth Rocks, Wyandottes or Rhode Island Reds were fed grain only, the average egg production ran from 52 to 70 eggs per hen per year. Where mill by-products, and meat scraps or milk were added, with these same breeds the minimum production was 66 eggs and the maximum 124, most of them averaging over 85.

In 1911 and 1912 at the Purdue Experiment Station an experiment has been carried out with Leghorn pullets in which all pens were fed corn, wheat, oats, bran and shorts in the same proportion. One pen had in addition 10 per cent. meat scraps, and another pen sufficient skim milk to equalize the amount of protein contained in the meat scraps. In reality this meant about as much milk as the chickens would drink. The result of the two years' work was that the meat scrap pen produced an average of 135 eggs per year per hen, the skim milk pen 135.5, and the pen without meat or milk 36 eggs per bird per year. The cost of feed per hen was respectively \$ 0.915, 1.085 and 0.73.

In the pen receiving milk, the egg production through the winter months (December-February) averaged almost seven per cent. more than in the pen fed meat scrap. For every \$ 2.50 invested in 100 lbs. meat scraps there was \$ 24.50 return and for every 30 cents invested in 100 lbs. of skim milk \$ 1.73 was returned.

About one third of the farmers that answered the questions use incubators.

At the Purdue Experiment Station good results have been obtained from brooders. The best results have not been obtained from lamp-heated brooders but by a wooden brooder house heated by a gasoline burner. This brooder is an eight-foot square colony house 6 ft. 6 in. high to the comb with an A-shaped roof, placed on runners so that it can easily be moved. The wood and material for such a house will cost about \$ 15 and the heater \$ 11.

1934 - **Egg-Laying Competitions in Australia.** — I. Egg-laying Tests at the Hawkesbury Agricultural College, Twelfth Year's Results. — *The Agricultural Gazette of New South Wales*, Vol. XXV, Part 5, pp. 421-433 + 2 plates. Sydney, May 1914. — II. HART, A. (Chief Poultry Expert) Report on third Egg-laying Competition at Burnley, 1913-14. *The Journal of the Department of Agriculture of Victoria*, Vol. XII, Part 6, pp. 353-362 + 7 figs. Melbourne, June 1914.

I. — *Twelve years of egg-laying tests at the Hawkesbury Agricultural College.*

In the accompanying table are summarized the results of the twelve years of egg-laying competitions, the last of which concluded on March 31, 1914.

In this year the innovation introduced was the single-pen system of testing individual hens in groups of six, and it revealed great individual differences; for instance in one group the best laid 224 eggs, the worst 188, and five exceeded 200. The test of judgment in selection, in which ten breeders supplied duplicate pens of six hens each, selected respectively as "good" and "bad" layers, confirmed the results of the preceding year, the average laying of the "good" pens being 14 eggs, and the value 1s 8d per hen per annum more than the "bad" ones. The winner of this section was able to select hens that gave a return of £ 1 8s 7d more than his six "bad" hens.

In the 1913-14 competition in all the sections, 660 birds took part. The breeds represented were: White Leghorns, Brown Leghorns, Black Orpingtons (one group of which exceeded the collective total of any other pen of heavy breeds), Silver Wyandottes, White Wyandottes, Minorcas, Plymouth Rocks, and Langshans.

	Winning total	Lowest total	Average per hen	Average value per hen		Cost of feed per hen		Profit over feed	
				s.	d.	s.	d.	s.	d.
1st	1 113	459	130	15	6	6	0	9	6
2nd	1 308	660	163	17	9	5	9	12	0
3th	1 224	532	152	12	9	4	6	8	3
4th	1 411	635	166	13	3	5	3	8	0
5th	1 481	721	171	14	10	5	10	9	0
6th	1 474	665	173	17	2	7	0	10	2
7th	1 379	656	180	19	2	7	10	11	4
8th	1 394	739	181	21	9	6	9	15	0
9th	1 321	658	168	16	6	6	4	10	2
10th	1 389	687	184	18	5	6	1	12	4
11th	1 461	603	178	19	4	7	3	12	1
12th	1 360	724	177	17	7	5	9	11	10

II. — *Third egg-laying competition at Burnley, 1913-14.*

The first yearly test conducted in the State of Victoria was at Dookie College in 1904-05 under the supervision of the Principal. This test was won by six White Leghorns, which laid 1313 eggs during the twelve months. In the next two yearly tests the winners were six Silver Wyandottes with 1296 eggs and six White Leghorns with 1314 eggs respectively.

If these figures be compared with those of the winning birds at the recent test at Burnley, the great improvement in the egg-producing qualities of White Leghorns will be seen.

In the 1913-14 test 63 pens of six birds each competed. Of these 54 contained White Leghorns, 5 Black Orpingtons, 2 Black Spanish

and 1 each Golden Wyandottes and Rose-combed Brown Leghorns. The winning pen of White Leghorns produced 1667 eggs during the twelve months, being an average of over 277 eggs from each bird. This pen also produced the greatest number of eggs during the four winter months, namely 533. The value of the eggs produced by the winning pen, at 1s 2d per dozen, was £8 2s 2d, which leaves a profit of £1 1s 4d from each bird over the cost of food. The twelve best groups produced an average of 251 eggs each for the year. The whole of the birds competing in the test averaged over 212 eggs each for the year, with a profit of 15s per bird over the cost of the food. In the heavy breeds the best pen of six Black Orpingtons laid 1216 eggs in the year.

Taking the average egg production, the White Leghorns are easily first, with an average of 216 eggs per bird. The averages for the other breeds were: Black Orpingtons 190, Black Spanish 189.7, Golden Wyandottes 172, and Rose-combed Brown Leghorns 169.

1035 - **Bee-keeping in Portorico.**— PHILLIPS, E. F. (Bureau of Entomology, U. S. Department of Agriculture) in *Portorico Agricultural Experiment Station Bulletin* No. 15, 24 pp. + 4 figs. Washington, 1914.

The Portorico Agricultural Experiment Station at Mayaguez has been interested in bee-keeping since 1908. In 1913 the Station and the Portorico Board of Agriculture requested the writer to inspect the conditions of bee-keeping in the Island. The present Bulletin is the report of the above inspection, which was carried out in May and June 1913.

Before the American occupation, it may be said that bee-keeping did not exist at all in Portorico. There were, however, numerous swarms of wild bees (introduced perhaps at the time of the Spanish conquest), the honey of which was collected. In 1908 the Portorico Agricultural Experiment Station imported five swarms of Italian bees and began to give practical instruction in bee-keeping. This was the beginning of the industry in the Island. Bees multiplied wonderfully in Portorico, and now the five initial swarms have become several thousand.

Bee-keeping is practised especially in the western part of the Island and chiefly in the neighbourhood of Mayaguez, mostly on an industrial scale, as every bee-keeper has from two to three hundred hives and some upwards of five hundred. Italian bees are almost the only ones kept. Some have experimented Cyprus or Carniola breeds; it must, however, be mentioned that the former gave decidedly negative results in the United States and in consequence are not to be recommended. The Langstroth hive with ten-bar frames is generally used with one or two lifts for the storage of honey, separated from the brood combs by a queen excluder. The bees collect honey almost all the year round, hence the production of honey is very heavy. Productions of from three hundred to five hundred pounds of honey per hive are recorded. It may be stated that a good bee-keeper in average localities produces about three hundred pounds of centrifugated honey per annum. The honey is collected several times in the course of the year. Only centrifugated honey is made, and it is sold in barrels containing 50 American

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gallons. According to the writer sufficient attention is not paid to the production of and trade in wax.

Foul brood (1) is unknown in Portorico, and in order to prevent its introduction it is forbidden by the law of September 3, 1913, to import into the Island hives or parts of hives, eggs, larvae, etc. Only queens may be imported, each with not more than 30 workers and enclosed in boxes. These are examined at the port of entry by the Board of Commissioners of Agriculture. But as foul brood is more likely to be imported with infected honey than with bees, a Bill has been presented with the object of forbidding the importation of honey which cannot be proved to come from healthy hives.

The exportation of honey from Portorico has risen during the last five years (1909-14) from practically nothing to about \$100 000. The difficulty and the cost of transport still constitute the most serious obstacles to the development and spread of bee-keeping in the mountainous Island of Portorico.

As for the plants supplying nectar for the bees, the trees used to shade coffee plantations are excellent; for this reason bee-keeping is chiefly practised where coffee is grown. The principal plants for bees are: *Inga lawrima* ("guama"), *Inga vera* ("guava"), very good shade plants for coffee, in bloom almost all the year round; *Boystonea boringuena* ("palma real"); *Cocos nucifera*, abundant throughout the Island; *Spondis lutea* ("jobo"); *S. purpurea* ("cirvela"); *Andira jamaicensis* ("moca" or "cabbage tree"); *Drypetes glauca* ("palo blanco" or "varital"); *Coffea arabica*, largely cultivated in the mountainous part of the interior of the Island, but as its flowers fall soon it has not the same value for bees as its shade plants; *Cupania americana* ("guara"); *Jambosa jambos* ("pomarosa", rose apple); *Mangifera indica* — the bees are also found of the over-ripe fruit of this tree which fall to the ground, but they do not injure the sound fruit; *Persea gratissima* (alligator pear); *Lantana* spp. ("lantana" or "cariaquillo"); *Borreria ocymoides* ("botoncillo"); *Musa* spp.; oranges, lemons and other citrus fruit, plentiful in the island, either wild or extensively grown; *Agave* spp.; *Pithecolobium* spp.; *Hymenaea baril* ("algaroba").

The following plants, which in other countries have been observed as supplying food to bees, are frequent in Portorico: *Arvicemnia nitida*; *Cassia* spp.; *Gossypium* spp.; *Hippomane mancinella*; *Melilotus* spp.; *Nicotiana tabacum*; *Erythrina* spp.; *Paritium tiliaceum* or *Hibiscus tiliaceus*, the fibre of which is used for making ropes; *Haemotoxylon campechianum*; *Saccharum officinarum*; *Acacia* spp. etc.

This new system of rearing silkworms aims at more hygienic conditions and a greater economy in leaves and labour. It enables the same number of worms to be reared as by the Lombard method, without requiring too great changes from the system in general use. It consists essential-

ly in the use of shallow trays with permeable bottoms, which allow air to pass and the excreta to fall, while the largest possible quantity of the leaves can be fed attached to the twigs.

From the time of hatching to the third moult, the worms are reared on trays made from reeds covered with paper and fed on loose leaves. The innovation is used after the third moult and consists of tiers of trays made from reeds bound together with spaces nearly half an inch between each reed. The alternate trays are covered with paper or cloth so as to catch the excreta from the one above. The bases of such trays can thus be replaced by movable frames of metal wirework, bare or covered with paper or cloth according to requirements. The trays are placed in pairs 8 to 12 in. apart and 20 to 24 in. between the pairs. Two days after the third moult mulberry shoots 16 to 20 in. long are given plentifully to the worms; when they have been defoliated they are moved, with the worms on them, to the open trays. During the period between the third moult and pupation some of the accumulated branches should be removed and the worms thinned out; at the time of pupating the space allowed should be about 15 sq. feet per gram of eggs.

A further saving of space may be obtained by placing a light cloth on sticks under each tray to catch the excreta; this need be only 4 to 6 in. below the tray.

The superiority of this system has been demonstrated in the experiments carried out by the travelling lecturer of Gallarate in 1914.

This year's results show:

- 1) a greater economy of space than with the Lombard system;
- 2) more hygienic conditions for the worms and very low mortality from "flacherie" and "jaunisse";
- 3) a saving of 4 to 6 cwt. of leaves per ounce of eggs;
- 4) a saving of $\frac{1}{4}$ to $\frac{1}{3}$ of the labour required by the old system;
- 5) a minimum of expense in effecting the improvements;
- 6) a better quality of silk and heavier cocoons, going 30 less to the kilo than with the old system.

1937 - Report on Sericultural Experiments in France during 1913. — LAMBERT, M., in *Bulletin Mensuel de l'Office de Renseignements Agricoles*, Year 13, No. 5, pp. 593-595. Paris, May 1914.

On the 30th of July 1913, the French Parliament voted a sum of £2 000 for the encouragement of sericultural experiments. This was distributed as follows: £160 was granted to the Department of Science and Repression of Frauds and £1 840 to the Department of Instruction and Agricultural Organization.

The latter amount was utilised as follows.

1. Institution of local sericultural competitions	£ 1 440
2. Creation of experiment fields and nurseries for mulberries at the Schools of Montpellier, Antibes, Ecully, Oraison and Valabre	200
3. Distribution of young mulberry trees and silkworm eggs in batches of 5 gms. for each experiment, to private persons, schools of agriculture and primary schools	120

4. Installation of material at the Sericultural Station of the School at Montpellier for comparative experiment on silkworm rearing by different methods, and expenses of the organisation of competitions and experiments £ 80

The local competitions were held in 36 cantons belonging to 18 departments. The number of silkworm rearers, farmers or silkworm egg-breeders taking part was 743. The members of the visiting commission were chosen, as for previous competitions, as far as possible amongst persons living in the particular departments concerned.

The carrying out of these dispositions was entrusted to an Interdepartmental Commission nominated by the Minister of Agriculture, which visited the 743 farms between October 1913 and January 1914. Of this number 585 were considered worthy of being recommended to the Minister for reward.

In the course of its visits the Commission made the following observations:

1) It is easily possible to determine with sufficient accuracy the quality of the products of the competitors at other times than the rearing periods and to classify them according to their merits.

2) The great majority of rearers hatch under defective conditions; worms are often reared in small unhealthy rooms, and the cultivation of the mulberries leaves much to be desired.

3) The rearers accept the advice offered by the Commission and are disposed to profit thereby.

With regard to the distribution of young mulberry trees, it has not been possible to give satisfaction to all requests. The number distributed has reached about 10 000.

1938 - **Fish Breeding in Switzerland in 1913.** — *Schweizerische Fischerei Zeitung*, Year 22, No. 5, pp. 122-126. Pfäffikon, May 1914.

During the breeding season 1912-13, 191 fish-breeding establishments were in activity, as against 192 in the preceding year. The area occupied by the incubation nurseries was 6943 square feet and the number of brood glasses was 591. Out of 121 550 550 eggs 97 422 880 fishes were hatched. Of this number, including 60 302 summer fish and one-year-olds, 97 150 882 (in 1911-12 81 050 630) were placed under State control in public waters.

The kinds of fish that were incubated are as follows:

	numbers
Salmon	1 292 400
Salmon hybrids	103 000
Lake trout	2 546 800
River and brook trout	7 373 030
Char	4 350 050
Grayling	2 227 500
White Fish (coregouns)	70 809 100
Pike	8 370 500
Perch	90 000
Eels	146 000
Foreign species	93 500
Brook char	21 000
	<u>97 422 880</u>

In order to defray the expenses of incubating and setting out the fry, the Confederation granted the Cantons the sum of £ 1385 (against £ 1300 in the preceding year) which was distributed among the owners of the various establishments.

In the above figures the work done in the Canton Valais is not included, as no data have been supplied.

The number of fishery inspectors in the service of the Cantons was, in the year reported upon, 17, to which at times are added 11 assistants; the salaries, daily and travelling expenses, amounted to £ 3981, against £ 3747 in 1912. The Confederation contributed one half of these sums. For the destruction of animals injurious to fish the Cantons spent £ 35 7s 6d, to which the Confederation contributed £ 16 11s.

In these figures on the inspection of fisheries, the Canton of Geneva is not included, as it did not ask for a grant or send in any report.

The Swiss Fishery Association received, as usual, a grant from the Confederation of £158.

The International Fishery Association for the Lake of Constance was granted by the Confederation, as well as by the other States bordering on the lake, a sum of £ 12 towards the expense sustained in 1913 for restocking the lake with fry.

On May 2, 1913, the Federal Council issued an Order concerning fishing in waters common to Italy and to Switzerland, as a supplement to the agreement of June 13, 1906, and which entered into force on June 1, 1913.

FARM ENGINEERING.

1039 **Report of the International Competition of Motor Tillage Machines at Chaouat, Tunis, in 1914.** — *Direction Générale de l'Agriculture, du Commerce et de la Colonisation, Bulletin*, Year 18, No. 79, pp. 445-503. Tunis, July 1914.

An international competition of motor tillage machines was organized by the General Direction of Agriculture of Tunis and held at Chaouat from the 15th to the 23rd of April 1914.

About 750 acres of stubble land were devoted to the trials of the various machines, twenty-four of which were entered, but, owing to various circumstances, only nineteen took part in the trials. Of these, nine were tractors, two portable engines with windlasses, four motor ploughs and four rotary tillage machines, including one hoeing machine.

The machines tried were the following :

Tractors. — America; Avery; Caterpillar; Case; Emerson (Big Four); Mogul; Ransomes; Rumely; Titan.

Portable engines with windlasses. — Two Franco-Hungarian portable gas engines.

Motor ploughs. — Moto-aratrice (Pavesi and Tolotti); D. K.; Stock; Akra.

Rotary tillage machines. — Charmes; Coupin; Motoculture française,

Hoeing machine. — Bauche.

Machine	Time employed in actual working	Area ploughed	Depth of furrow	Consumption of fuel and oil	Fuel per acre	Cost of fuel per acre (2)	Area ploughed in 10 hours
<i>Tractors:</i>	hrs. mins.	acres	inches			s. d.	acres
America (1) 40-50 HP. With six-furrow plough	2 3	2.47	7.87	8.58 gals benzine 10.62 gals benzine 6.44 lbs oil	3.47 gals	5 7.57	11.86
Avery 80 HP. With eight-furrow Cocksbutt plough . .	2 31	4.94	"	0.92 gals benzine 23.69 gals Atlantic petrol 2.64 lbs. oil	2.15 gals 0.15 gals benzine 3.94 gals petrol	3 6.16 3 1.38	19.64 18.94
Big Four 55-60 HP. With six-furrow John Deere plough shares working	3 11 4 5	6.03 3.46	" "	13.11 gals Atlantic petrol 3.41 gals benzine 1.81 lb. oil	3.79 gals petrol 0.97 gals benzine	4 8.00	8.44
Caterpillar 60 HP. With eight-furrow Deere plough, only six shares working.	4 20	6.67	"	22.44 gals Atlantic petrol 2.40 gals benzine 4.95 lb. oil	3.36 gals petrol 0.36 gals benzine	3 3.85	15.39
Mogul 60 HP. With six shares in two independent frames.	4 32	7.14	"	33.5 gals Atlantic petrol 24.2 lbs oil	4.70 gals petrol	3 9.45	15.74
Ransomes 35-40 HP. With four-furrow Ransomes gang plough	5 7	5.41	"	17.59 gals Adriatic petrol 1.94 lbs oil	3.26 gals petrol	2 5.25	10.58
Rumely 30 HP. With four-furrow plough	4 8	4.72	"	22.13 gals Adriatic petrol 0.34 gals benzine 2.66 lbs. oil	4.65 gals petrol 0.34 gals benzine	3 6.16	11.42
Titan 45 HP. With plough with four independent shares <i>Portable engines with windlasses:</i>	4 0	4.03	"	19.28 gals Adriatic petrol 11 lbs. oil	5.0 gals petrol	3 9.06	9.63
Franco-Hungarian (16-20 HP) water-gas engines with Rud. Sack five-furrow plough	2 36	2.00	9.84	115.96 lbs charcoal 26.00 gals water	57.88 lbs charcoal 13 gals water	1 5.48	7.71
do. with a one-share Hajac plough	2 37	0.56	19.29	117.97 lbs charcoal 31.17 gals water	210.07 lbs charcoal 53.66 gals water	5 3.73	1.97
<i>Motor ploughs:</i>							
Moto-aratrice 16-20 HP. (Pavesi and Tolotti) with three shares fixed in front	4 14	3.04	7.87	9.28 gals benzine 1.1 lb oil	3.04 gals benzine	4 1.107	7.16
D.K. motor plough, 80-105 HP with three shares . .	2 22	5.68	"	11.48 gals benzine 6.08 lbs oil	2.00 gals benzine	3 3.27	23.98
Stock, motor plough, 45-50 HP	2 36	6.52	"	11.33 gals benzine	1.74 gals benzine	2 10.07	24.70
<i>Rotary tillage machines:</i>							
Charnes, pulveriser, 30 HP	5 52	3.38	0.84	22.02 gals benzine	6.51 gals benzine	10 7.45	3.82
Meyenburg's motor cultivator, 30 HP	4 5	0.62	7.08	3.52 gals benzine	5.69 gals benzine	9 3.29	5.68
do. second trial	4 41	1.85	7.87	13.64 gals benzine	8.01 gals benzine	13 1.88	3.95

(1) Owing to an accident the tractor America was not able to take part in the trials with the other machines, but was tried at the farm of the Colonial School of Agriculture.

(2) The cost of the fuel has been calculated: Benzine is 7.46 d per gal, Atlantic petrol 9.73d per gal, Adriatic petrol 9.0 d per gal and charcoal 28 9.87d per cwt.

The land was situated in the extensive plain of Chaouat. The soil was very homogeneous, compact and dry, so that the heaviest machines sank but little into it.

Most of the trials as to consumption of fuel were carried out on strips 3493 feet long by 98 wide.

The accompanying table (opposite) summarizes the results of the trials. Only the cost of the fuel used is given, as the total cost of the work depends upon several variable factors, the chief of which is the amortizement, which in its turn varies considerably with the amount of work done in the course of the year, the quality of the materials used, etc.

As already stated several dynamometer trials were also made, the results of which are given in the Report. The depth of work was regulated so as to require a fairly constant traction together with a maximum effect of the tractor, without diminishing too much the number of revolutions of the motor.

The average effort ranged from 1015 to 1624 lbs. per square foot. In a soil requiring an effort of 1421 lbs., a furrow about 8 inches deep by 12 wide demands a team of eight mules or 12 native oxen.

1040 - **The Reaper-Thresher.** — SHAW, J. W., in *The Agricultural Gazette of New South Wales*, Vol. XXV, Part 5, p. 376. Sydney, May 2, 1914.

The Reaper-Thresher, more commonly known as the "header", is a comparatively new machine and is becoming more popular from year to year.

One great difference between these machines and a harvester is that the heads instead of being stripped or combed off are cut off by a knife which is worked at the rear of the comb. The straw is drawn through the comb until the heads, assisted by the reel, come in contact with the knife. The fact of the heads being cut greatly lessens the draught. Should the ground be soft or the straw weak, the wheat is not pulled up by the roots and choked in the comb, nor is there any choking when the crop is dirty with thistles or other weeds.

When the heads are cut they are carried by means of the reel on to the canvas conveyors at the rear of the comb, which then carry them to the feeder of the threshing drum; this drum is very large and by means of pinions its speed may be varied to meet varying conditions. A second drum is placed at the rear of the machine to re-thresh any broken heads which may have escaped the first threshing.

The straw is thrown out at the side at the rear of the wheels. The grain is fed evenly on to the riddles, where it is winnowed, and is then carried by elevators into the grain box, which has a capacity of five bags.

The machine takes an eight-foot cut, and with two average teams of five horses each, in a fair crop, from 15 to 20 acres may be harvested in a day. There is very little waste of grain as compared with some other harvesters, and the lightness of draught and its power to deal with a weedy crop make the header a most valuable addition to the wheat grower's plant.

1041 - **Straw Press Binder with Two Pincer-like Groups of Arms working together.** — *Maschinen Zeitung*, Year 12, No. 8, pp. 92-93. Berlin, April 15, 1914.

A new straw press for tying straw into bundles as it issues from the threshing machine has been devised by Messrs. Volkenborn of Langenberg, and patented in Germany under No. 270 841.

It consists of two pincer-like groups of arms, which are moved towards each other by the action of one hand lever.

The press is shown open in fig. 1, half closed in fig. 2, and closed in fig. 3.

It consists of a frame a_1 a_2 and a cross piece b , on which the arms c and d are fixed to the pivots f and g . The arm d is connected by the bar h , hinged in i to the hand-lever m , the fulcrum of which is in k on the cross-piece b .

The other press arm c is worked by the bar o , which rests on the bolt p and is joined to the hand-lever m in n . This bar carries a roller q which runs along the bottom of the lower branch r of the arm c .

The lever is so arranged that the pressure increases towards the end of the operation and that when the press is in its closed position (fig. 3) the lever is pressed against the bolt s and kept there.

Thus, by a simple movement of the lever m , not requiring any great exertion, the straw is pressed and kept so until tied.

In order to prevent fresh straw from the threshing machine sliding down the inclined plane y onto the binder, the arm c carries a kneed piece t which raises the straw fender x and keeps it there till the press is again opened.

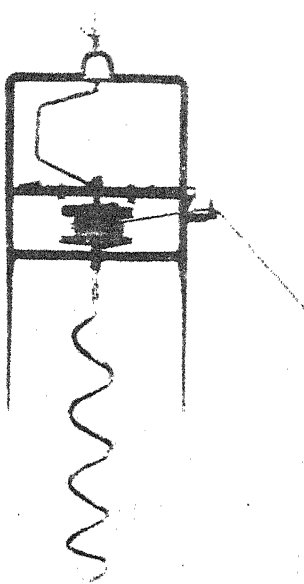
1042 - **Swift's New Hay Elevator Fork.** — *The Implement and Machinery Review*, Vol. 40, No. 473, p. 682. London, September 1, 1914.

The accompanying illustration shows the new hay fork elevator for the building of haystacks, devised by Mr. A. J. Swift of Eccleston, Lancashire. The spiral stem and the two side spikes are, by four or five turns of the crank in the upper part of the fork, pressed down into the hay, and grip a load. When the load is elevated to the desired height the operator simply pulls a rope gently, causing the spiral to unwind, when the hay falls off into several different places on the stack instead of being dumped in one heap.

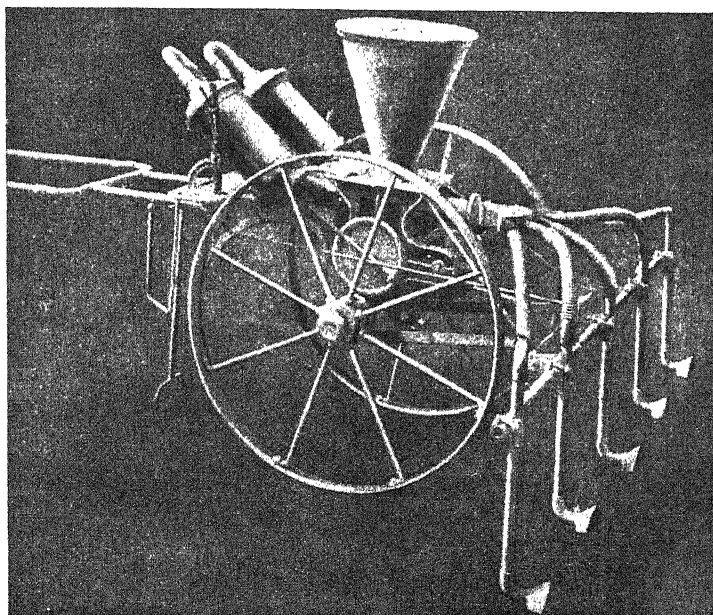
1043 - **Machine for Pickling Seed Wheat.** — ARVAY, ERNST, in *Wiener Landwirtschaftliche Zeitung*, Year 64, No. 15-4916, p. 135. Vienna, March 14, 1914.

It often happens in practice that smut appears on the crop notwithstanding the pickling given to the seed. This is due to the careless way in which the pickling is usually conducted, and which often consists in rapidly dipping baskets containing the seed into fungicide solutions. Besides being unreliable, this process is also costly as it requires much labour.

In order to avoid these drawbacks the writer devised and constructed a pickling machine which consists of a trough made of pure copper, to contain a solution of copper sulphate, in which a horizontal drum pierced



Swift's Hay Elevator Fork.



Randell's Dry Sprayer.

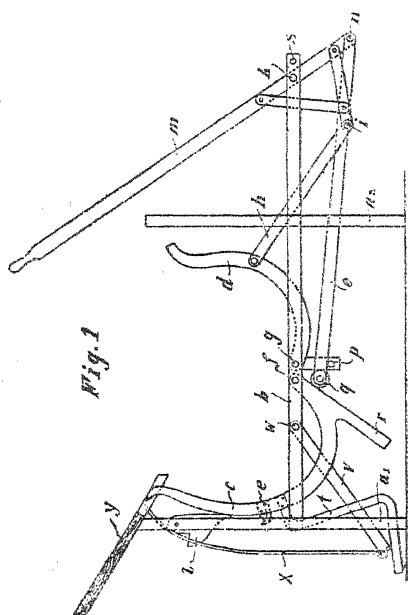


Fig. 1

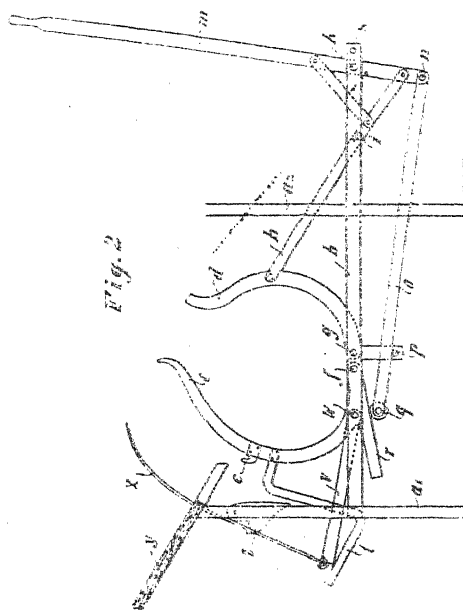


Fig. 2

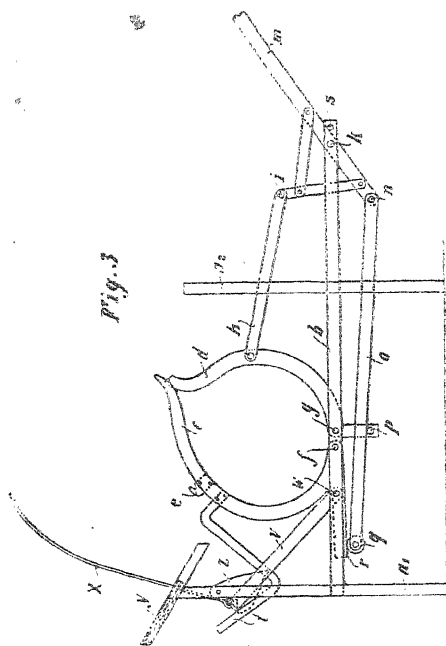


Fig. 3

STRAW PRESS BINDER.

- Fig. 1. --- Open.
Fig. 2. --- Half closed.
Fig. 3. --- Closed.

with minute holes revolves. The seed is poured into a hopper, the outlet of which can be closed by a slide, whence it falls into a channel leading into the drum. In this an endless screw pushes the wheat along slowly so that it stays from three to five minutes in the solution, every grain being wetted by it. At the other end of the drum another screw ejects the pickled grain.

With this simple machine a saving of about three-quarters of the labour required by the primitive method is effected and the work is done thoroughly.

1044 - **Randell's Dry Sprayer.** — *The Implement and Machinery Review*, Vol. 40, No. 472, p. 559. London, August 1, 1914.

Among the machines exhibited at the Royal Agricultural Society's Show at Shrewsbury in July of this year there were two entirely new machines for dry spraying built by Messrs. F. Randall and called the "Simply Perfect". One was fitted with five nozzles, as in the accompanying illustrations, for spraying as many rows of potatoes, for large farms, the other with two nozzles for small holdings. The blast is not produced by a fan but by two cylinders and pistons, which run at much less speed, giving a continuous blast and requiring less power to drive, a small pony being sufficient.

An agitator is provided and the feed is so arranged that any quantity of powder can be sprayed. Roller bearings are used throughout. The price of the larger machine is £30 and of the smaller one £15.

1045 - **Wallace's Portable Milking Machine.** — *The Implement and Machinery Review*, Vol. 40, No. 473, p. 672. London, September 1914.

Now that the importance of the purity of milk is universally recognized, out of door milking is advocated as a means of ensuring greater cleanliness than indoor work. In order to facilitate milking in the open, Messrs J. and R. Wallace of Castle Douglas, Scotland, have devised a portable milking machine. This plant consists of a portable house and a portable wooden framework to which the cows can be tied. The house contains a 3 ½ HP. Capel petrol-paraffin engine connected to a vacuum pump and a vacuum storage tank. An iron pipe is fixed along the portable frame just above the cows' heads and this is connected to the vacuum tank and pump by a flexible steel tube. The framework provides accommodation to twelve cows, the animals being held during milking by a sliding bar which grips them behind the head. Six cows are milked at once and directly one is finished another takes its place. Each day the plant is moved to a different part of the field so that the cows always stand on clean grass.

1046 - **Review of Patents.**

Tillage machines and implements.

Austria	66 708. Skid for wheels to facilitate the turning of tillage machines.
Canada	154 074. Rotary plough.
	154 093. Stone-picking machine.
	154 270. Plough.

- Canada 154 304. Plough fender.
154 308. Weeder.
154 334 and 154 352. Ploughs.
154 374. Harrow.
154 476. Plough mechanism.
154 552. Plough.
154 781. Machine for hoeing potatoes.
- Denmark 19 032. Motor plough.
19 118. Shares for rotary plough.
19 124. Motor plough.
- France 469 985. Hoeing machine with balanced rotating axes.
- Germany 274 831. Cleated tyres for the driving wheels of agricultural machines,
especially motor ploughs.
274 936. Mould board built in two parts, especially for reversible ploughs
with two shares situated back to back.
274 958. Tillage machine with revolving drums bearing hoes.
137 728. "Campione" motor plough.
141 652. "Ronco" plough.
- Italy
- United Kingdom 7 118. Cultivators.
8 595. Trench excavator.
9 880. Steering gear for motor ploughs.
9 992. Side share for ploughs.
10 276. Digging machine.
- United States 1 103 450. Combined clod cutter and crusher.
1 103 284. Harrow.
1 103 293. Subsoiler plough attachment.
1 103 543. Plough adjusting mechanism.
1 103 595. Cultivator blade.
1 103 929. Land roller.
1 104 027; 1 104 293; 1 104 329. 1 104 636. Cultivators.
1 104 187. Plough lift for gang ploughs.
1 104 569. Plough.
1 104 748. Disk harrow.
1 105 032. Reversible plough.
1 105 198. Cultivator.
1 105 450. Three-row wheel corn cultivator.
1 106 119. Gang plough.
1 106 213. Orchard plough.
1 106 312. Subsoil attachment.
1 106 190. Machine for gathering stones.

Manure distributors.

- United Kingdom 7 121 and 7 663. Manure distributors.
- United States 1 104 247. Agitator and feeder for fertilizer distributor.

Drills and sowing machines.

- Canada 154 156. Corn planter.
- Germany 274 832. Combined potato laying machine and manure distributor.
- United Kingdom 7 345. Drills.
7 912. Machine for making holes for planting potatoes.
9 931. Potato planters.

- United States 1 103 299 ; 1 104 214. Corn planters.
 1 103 593. Marker for corn planter.
 1 103 831. Seed planter.
 1 104 602. Attachment for grain drills.
 1 104 725. Potato planter.
 1 105 075. Seeder.
 1 105 665. Corn planter.

Reapers, mowers, etc.

- Austria 66 663. Fastening for the tines of tedders, rakes and the like.
 Canada 154 078. Sheaf loader.
 154 132. Harvester.
 154 160. Grain rake.
 154 166. Hay gatherer and loader.
 154 339. Sharpener for lawn mowers.
 154 356. Hay press.
 154 361. Harvester mechanism.
 154 464 ; 154 472. Railway mowers.
 Denmark 19 113. Device for binders.
 Germany 274 699. Apparatus for conveying the reaped cereals to the binding mechanism in binders.
 274 748. Process and apparatus for drying clover.
 United Kingdom 6 578. Track clearer for mowing machines.
 7 215. Lawn mowers.
 9 443. Reaping and mowing machines.
 United States 1 103 766. Corn harvesting machine.
 1 104 020. Tooth for hay rakes.
 1 104 213. Header device.
 1 104 240. Binder sickle guard or tooth.
 1 105 235. Harvester.
 1 105 445. Pea harvester.
 1 105 751. Mowing machine.
 1 106 018. Harvesting machine.

Machines for lifting root crops.

- Austria 67 010. Beet topping machine.
 Canada 154 098. Potato separator.
 154 180. Potato digger.
 Denmark 19 082. Potato lifter.
 19 094. Beet topping apparatus.
 Germany 274 623. Machine for collecting and sorting potatoes.
 United Kingdom 7 084. Potato harvester.
 United States 1 103 321. Potato digger.
 1 105 327. Potato sorting apparatus.
 1 105 427. Potato sorter.
 1 105 728. Beet harvester.

Threshing and winnowing machines.

- Austria 66 664. Automatic feeder for threshing machines with apparatus for cutting the sheaf tie.
 Germany 274 667. Automatic feeder for threshing machines.
 274 937. Grading apparatus with fan and several screens with return planes between them.

- Italy 142 523. Improvements in straw elevators.
- United Kingdom 7 971. Improvements in threshing machines.
- United States 1 103 324. Threshing machines for standing grain.
 1 104 033. Attachment for threshing machine feeders.
 1 104 677. Corn sheller.
- Other agricultural machines.*
- Austria 66 347. Apparatus for tying up live stock in stables.
 66 352. Milking machine.
 66 357. Centrifugator for frothy liquids.
 66 450. Milking machine.
 66 655. Drinking trough.
 66 666. Portable circular saw for cutting sugar cane.
 66 674. Device for untying live stock.
- Canada 154 102. Wheel jack and belt-tightener.
 154 116. Rossing machine.
 154 139. Milking machine.
 154 198. Cherry stemming machine.
 154 204. Bean sorting belt.
 154 221. Fruit picker.
 154 315. Grain tester and seed separator.
 154 434. Yeast tester.
 154 499. Tree scraper.
 154 632. Milking machine.
 154 675. Fruit grading machine.
 154 786. Grain cleaning mill.
 154 797. Incubator.
 154 838. Churn.
 154 843. Tree sprayer.
- Denmark 19 033. Device for forks and similar implements.
 19 035. Milking machine.
 19 178. Straw baler.
- Germany 274 498. Steering swivel for agricultural machines.
 274 499. Cleaning apparatus especially for cereals.
 274 501. Hand stump-pulling machine.
 274 557. Portable sprinkling apparatus.
 274 624. Device in balers for passing the wire led on both sides of the bales.
 274 666. Apparatus for working agricultural motors by electric power.
 274 700. Straw press.
 274 702. Milk strainer with several filters situated over each other and kept
 in position by tension rings.
 274 889. Machine for raising clay from moor soils.
 274 938. Machine for slicing beets, potatoes and the like.
- Italy 140 473. Hay baler.
 142 047. Automatic watering mechanism.
 142 145. Semi-automatic system of threading the needle for binding the
 bales in fodder balers.
 142 162. Apparatus for untying animals in stables.
 142 282. Spraying pump with automatic agitator.
 142 289. Apparatus for killing moles.
 142 381. Continuous action machine for crushing and pressing grapes and
 removing the stalks.

- United Kingdom 6 458. Brooder.
 6 583. Machine for husking and cracking cohune nuts.
 6 729. Germinating boxes.
 7 568. Hedge trimmer.
 7 612. Apparatus for extracting fruit juices by steam.
 7 666. Weed puller.
 7 671. Retting apparatus.
 8 448. Spraying machine.
 8 473. Baling press.
 8 544. Apparatus for reducing wheat by successive grinding by rollers.
 9 352. Apparatus for preparing food for animals from peat.
 9 489. Apparatus for drying grain.
 9 554. Baling press.
 9 776. Hay loader and collector.
 9 968. Rubber extractor.
 10 012. Portable root cutter.
 10 037. Traction engine.
- United States 1 103 287. Hay fork.
 1 103 326. Fodder loading apparatus.
 1 103 492. Hay stacker.
 1 103 678 ; 1 104 277 ; 1 105 551 and 1 105 562. Tractors.
 1 103 733. Stacker.
 1 104 312. Hauling device for agricultural machines.
 1 104 431. Fruit gatherer.
 1 104 537 and 1 106 046. Traction engines.
 1 104 847 ; 1 104 934. Traction wheels.
 1 104 885. Stacker.
 1 104 962. Pump.
 1 105 007. Hay press.
 1 105 086. Steering gear for traction engine.
 1 105 686 ; 1 105 862. Tractors.
 1 105 916. Hay and grain loader.
 1 106 202. Milking machine.
 1 106 251. Baling press.

RURAL ECONOMICS.

1047 - **The Influence of Machines and Implements upon the Profitableness of Farms of Different Sizes.** — *Deutsche Landwirtschaftliche Presse*, Year XXXXI, No. 10, pp. 740-742; and No. 61, pp. 749-750. Berlin, July 29 and August 1, 1914.

The present paper is a résumé of the discussions and considerations contained in the recent work of Dr. Lichtenberger on the influence of agricultural machinery on the organization and profitableness of farms of different sizes, and which may be summarized as follows :

1. In farms grouped according to size, the relative profitableness of one class as compared with that of other classes is the result of a number of factors among which are included the use of machines and implements together with other economic and natural conditions.

2. Agricultural machinery has proved useful in increasing the profits of farms of all classes of sizes provided natural and economic conditions allowed machines to be used.

3. When farms of different classes of sizes compete with each other under equal conditions, the farm in which natural and economic conditions allow the greatest intensity of farming, will draw the greatest profit from the use of machinery.

4. As a rule, large farms are in the most favourable condition to make profitable use of machines and implements. The relative profitability of such farms is influenced in the highest degree by the use of machinery.

Medium-sized farms occupy in all respects the most difficult position : they require machines just as much as the others but must pay a higher price for their work. Nevertheless these farms also, especially of late, find their profitability increased by the use of machinery.

In small farms the number of implements and machines that can be profitably employed is limited. This fact, however, does not place small farms in a condition of inferiority to medium and large farms, as the former have no absolute need of machines and implements. On the other hand implements and machines, in so far as they are applicable in the small farm, are of decided assistance in increasing its capacity of competition and its relative profitability. For this class of farms cooperation in the use of machines is most beneficial.

5. Without entering into the question of comparing absolute conditions, but only examining how far the recent development of machines and implements has altered the relative profitability of the different classes of farms, it will be found that the use of machinery at first gave large farms a great advantage over the smaller ones ; this advantage in respect of medium-sized farms has gradually diminished in consequence of the recent development of machinery and of the steadily increasing intensity of farming. This process has especially been accelerated by the progress of electrical appliances. It is electricity that provides medium and especially small farms with the most suitable motive power. To a great extent also the so-called universal machines (namely those that by means of various attachments can be altered so as to perform different kinds of work) assist in spreading the use of machines to the smallest farms.

6. For the calculation of the cost of the work of machines Dr. Lichtenberger considers the figures proposed by Fischer and Lang for amortization and repairs as the most suitable and those which best meet the conditions of small farms. According to them the rate consists of a fixed portion of 8 per cent. per annum of the purchase price and a variable one per day. The former represents interest at 4 per cent. and 4 per cent. for amortization. The variable portion is determined in each case by the kind of machine and the number of days in the course of the year in which the machine is used, and varies, according to Fischer, between 0.09 and 0.5 per cent. per day's work. Through the lesser use of machines in small farms a compensation within certain limits is obtained between

large and small farms; otherwise on account of the greater purchase cost per unit of performance the amortization and repairs would be absolutely a larger item in small farms than in larger ones. The cost of teamwork should also be reckoned at lower rates in small and medium farms. If, further, the cooperative use of machines and the use of universal machines be considered, the conclusion can be drawn that the cost of machine work limits only to a very moderate degree the relative profitableness of small and medium farms.

1048 - **The Agricultural Labourers Required on Farms under 100 Hectares (247 Acres) in Extent.** — GERLACH, OTTO, in *Archiv für exakte Wirtschaftsforschung*, 15th Complementary Part, pp. 1-13. Jena, 1914.

The Chamber of Agriculture for the Province of East Prussia organized an enquiry in 1901 and 1902 on the conditions of agricultural labour; this was extended also to peasant farms. The writer discusses the results of this enquiry on the amount of labour required, and on the way in which this want was met, in 4600 farms occupying a total area of 197 600 acres. These results are collected in the following table :

Size of farm in acres	Average requirement of				Want of permanent labourers' families	Labour of owner and of his wife	
	Permanent labourers		Temporary labourers				
	Number	Days' work	Number	Days' work			
18 to 25	1	300	1	17-20	—	Both work always in all the farms	
37	2-3	600-900	1-2	40	not yet felt	" " "	
74 to 87	5	1300-1500	2-3	54-60	already felt (in 54 out of 138 farms)	Both generally work	
123	7-9	1550-2500	3	110-115	almost everywhere	The owner works only temporarily.	The owner's wife works only in the household
185	8-10	1600-2900	2-5	110-115	is common	The owner works only temporarily and seldom	" " "

The usual limit of the size of farms worked by the owner and his wife alone is from 12 to 15 acres. In the above table the data refer to the amount of labour required beyond that of the owner and his wife.

The influence of the distance from the village to the market or to the nearest railway station on the want of labour, could not be determined. A greater influence seems to be exerted by the state of the field roads and the extent of pastures.

On the supply of labour in 1288 farms of all classes of sizes between 10 and 250 acres covering an area of 108 700 acres the following figures afford information :

	On the 1288 farms		
	were required	were available	were wanting
Members of the family.	1 464	1 464	0
Permanently occupied labourers' families	870	668	202
Farm servants	3 178	2 193	985

The number of permanent adult labourers required was 5512; of this number :

26.6 per cent. was supplied by members of the owner's family.

36.4 per cent. by farm servants.

16.2 per cent. by married helps.

20.8 per cent. was wanting.

The lack of permanent labour is greatest on farms between 50 and 70 acres in extent, being 29 per cent.; it is 28 per cent. on farms between 35 and 50 acres; it ranges from 18 to 22 per cent. on large peasant farms, while on smaller ones it is much less (16 and 12.5 per cent.) and it disappears altogether in the smallest farms. The unfavourable position in this respect of farms between 35 and 70 acres is explained by the fact that the collaboration of the members of the owners' families diminishes considerably, while they are unprovided with housing for labourers' families and consequently have to put up with unmarried farm hands, who are the most difficult to get.

1049 - **Influence of Economic Conditions on the Methods of Farming.** — AERBOE, FRIEDERICH. Special reprint from *Jahrbuch der Deutschen Landwirtschafts-Gesellschaft*. Berlin, 1914.

The total process of development of public economy reacts upon agriculture chiefly by the difference between the prices of production on one hand, and the prices of the means of production on the other, and then also by the reciprocal relations of the prices of the individual agricultural products and of the several agricultural means of production. In a low stage of development of agriculture the prices of agricultural produce are low considered absolutely, and especially so in comparison with wages and with the prices of the purchasable means of production. Consequently the aim of the farmer must consist in cultivating large areas of soil with the employment of small quantities of labour and capital so as to ensure for these two factors a large harvest to compensate for its low price. At a higher stage of development, with higher prices for agricultural produce and comparatively low prices for the means of production, it becomes advantageous to increase the employment of labour and of live and dead stock per unit of area, so long as a surplus of production can be obtained.

Between these two extremes there are, however, innumerable stages which are characterized in the whole public economy by a progressive saving of the soil following upon its heightened utilization. In agriculture this sav-

ing of the soil and increased utilization is attained by the successive preference given to such forms of utilization of the soil as require, it is true, a greater outlay on labour and live and dead stock, but which yield a much larger quantity of produce per unit of area, and also by concentrating the crops on the old cultivated areas and extending the utilization of the soil to always poorer areas or such as are always more difficult to improve.

This evolution is naturally accompanied by the creation of always new systems of farming which differ from each other especially in the following characters :

1. In the ratio between the different types of cultivation, especially in the ratio between woods and pastures on the one hand, and arable land on the other.
2. In the proportion of fallow to arable land.
3. In the proportions of the various crops, especially of hoed crops.
4. In the kind and extent of the crop grown for green manuring and especially in the proportion of catch crops.

The evolution of the systems of farming and the degree of its intensity thus depend chiefly upon the variations of the above conditions. With the general organization of the farm the importance and extent of the individual crops and cultural methods vary also and with them the tillage of the soil, the manures applied, the kind and quantity of seed, the harvesting, etc.

The writer considers the different degrees of development of a number of cultural methods in general and of their application to several plants. He distinguishes also as regards manuring the following regions of intensity or degrees of intensity in the use of farmyard manure, artificials and green manures, starting from the lowest or most unfavourable economic condition :

A. Regions where farmyard manure and artificials are used :

1. Regions in which the plant food diminishes.
2. Regions in which it is replaced.
3. Regions in which it is increased.

or

1. Regions that are not manured.
2. Regions in which only farmyard manure is used.

3. Regions in which farmyard manure and artificials are used

- a) artificials chiefly containing nitrogen;
- b) artificials chiefly containing phosphates;
- c) artificials chiefly containing potash.

B. Regions in which green manuring is practised :

1. Regions without green manures.
2. Regions in which green manures are the chief crop.
3. Regions in which plants for green manures are sown among cereals.
4. Regions with plants for green manures sown among cereals or after harvest.

With the increasing prosperity of economic conditions the intensity of manuring increases also, with regard to outlay of both labour and capital. The same holds good, especially in the amount of labour, in the regions where weeds are controlled, of which the writer distinguishes ten :

1. Destruction of weeds only by changing arable land into pasture.
2. Do. by fallowing and ploughing between the principal crops.
3. Do. by surface ploughing, cultivating, harrowing, etc., but always by means of team work between the harvest and the preparation of the soil for the chief crops.
4. Do. by horse hoeing during the growth of the crops. Hand hoeing only in gardens.
5. Hand hoeing in field hoed crops.
6. Hand hoeing of wheat; possible through extension of hoed crops.
7. Hand hoeing of oats also, thanks to the still greater extension of hoed crops.
8. Hand hoeing of barley also.
9. Cultivation of rye in spring with Zehetmayr's roller harrow.
10. Destruction of weeds and plant diseases by means of different sprays.

From the above it will be clearly seen that all means of controlling weeds which entail labour are avoided in the lower stages of development, while in the higher ones those which demand extent of soil are abandoned.

The whole change in the development of the measures for the destruction of weeds consists in expending labour in order to save soil, which is also effected by concentrating the crops.

In the culture of rye three different regions are distinguished according to the density of sowing, as the quantity of seed diminishes inversely with the intensity of farming.

In the division of the regions of beet growing, the writer considers most of all their position in the rotation while with mangolds he gives greater importance to the methods of culture.

A. Regions in which beets are grown.

1. Beets only in small inner rotation, which through the frequent cultivation of hoed crops are kept fairly free from weeds.

2. Beets in the main rotation and for several successive years, in order to facilitate the destruction of weeds at least in the second and third years.

3. Beets in the main rotation in regular alternation with cereals.

B. Regions in which mangolds are grown:

1. Only seedlings planted out immediately after ploughing.

2. Only seedlings planted in levelled and half loosened soil.

3. Partly seedlings and partly sown mangolds.

4. Only sown mangolds.

This table also shows that the object of the farmer must be to get most returns from the outlay on labour in the lower stages, and in the higher ones greater returns from the soil area. The same conclusion may be drawn also from the succession of the potato regions:

1. Planting the potatoes after ploughing, earthing them up after repeated harrowing. Deep sowing is indispensable.

2. Planting potatoes in well loosened soil, alternately earthing up and carefully harrowing; sowing not so deep.

3. Alternate earthing up and hoeing with a horse-hoe lengthwise between the rows.

4. As No. 3, but hoeing crosswise.

5. No harrowing. The destruction of weeds effected only by hoes and chain harrow; in some cases a second hoeing by hand. Superficial sowing.

In this way areas of cultivation for all the other cultivated plants according to the methods of more extensive or more intensive cultivation and corresponding to the more or less advanced stage of economic conditions might be outlined. It is easy to understand that in different stages of development different demands are made upon cultivated plants and that consequently the aims of plant breeding must be different according as the plants are bred for localities of extensive or intensive farming. In order to illustrate this the writer draws up a table in which he compares the two extremes of wheat breeding, namely for extensively and for intensively farmed localities.

A. In the lower stages of farming or in localities situated in unfavourable economic situations, the returns per unit of area are secondary considerations, while the returns obtained by labour and capital are the principal ones; consequently the aims of breeding are:

1. Slight demands as to labour.

2. Slight need of manures.

3. High power of competing with weeds and the like.

4. Easy harvesting by machinery even should the quality of the product suffer.

5. Quantity and quality of straw secondary considerations.

B. In a higher stage of farming or for localities in economically favourable situation, the yields per unit of area are the chief considerations, while the yield per day's labour and per unit of capital are secondary matters; consequently the aims of breeding are:

1. High capacity of utilizing the labour spent upon it by high yields per unit area.

2. High capacity for absorbing fertilizers, even if accompanied by loss of thriftiness.

3. The increased care of the plants allows of their possessing a lower degree of resistance to weeds and the like.

4. High quality of the harvested grain, even if it should entail a greater consumption of labour.

5. High selling value of the straw and large quantities of it, increasing considerably the money value of the harvest.

According as these objects are more or less completely attained by breeding, the importance and the position of the individual cultivated plants change in the course of development. Those plants which by a great increase of harvest best repay the intense care and manuring bestowed

upon them will acquire most importance. In this connection the writer compares rye and oats. With oats the work of improvement was begun in Germany earlier than with rye and has obtained superior results. Consequently for many years oats have been given an always better position in rotations. From the lowest position it occupied in rotation, it has risen now to the second place, and where hoed crops cannot follow a green manure crop, oats occupy the first place. Only the later brilliant successes of rye breeding have retarded this development, but recently it has received a new impulse from the selection of Lochow's Yellow oats, which possesses all the desired qualities in a measure which had never been attained before.

1050 - **The Influence of the Prices of Agricultural Produce upon the Farming Conditions in Switzerland.** — LAUR, E. Reprint from *Schweizerischen landwirtschaftlichen Zeitschrift*, Year 1914, Nos. 26, 27, 28.

Swiss agriculture realized in the period from 1906 to 1913 about 22 per cent. more than in the period between 1901 and 1905 for the same amount of yearly production. In the same time the prices of farms, and especially of separate pieces of land, have increased considerably. That this rise in the prices of land does not always signify an increase of the value of the bare soil is proved by the following figures which show the changes in the values of farms and of the bare soil per acre of cultivable land between the period 1901-05, and that from 1906 to 1912, according to the book-keeping results obtained by the Swiss Peasants Secretariat.

Results of all the yearly balances from the investigations into profitableness.

Per acre of cultivable area	1901-05			1906-12			Increase			
	£	s	d	£	s	d	£	s	d	per cent.
Capital in:										
Farm	70	11	11	72	10	5	1	18	6	2.80
Soil	37	4	1	37	10	11		6	5	0.86
Buildings, improvements and plantations	33	7	5	34	19	6	1	12	1	4.80

If in the corresponding years only the farms that in those years began to have their accounts audited are considered, the results are as follows:

Per acre of cultivable area	1901-05			1906-12			+ Increase — Decrease			
	£	s	d	£	s	d	£	s	d	per cent.
Capital in:										
Farm	72	15	3	77	4	1	+ 4	8	11	+ 6.10
Soil	39	19	0	39	7	6	—	11	7	— 1.45
Buildings, etc.	32	16	3	37	16	8	+ 5	0	5	+ 15.30

From the above figures it appears that on average of all the farms examined the capital in soil per acre has remained very nearly the same, and that the increased price of farms is mostly due to the greater value of buildings, improvements and plantations.

The greater receipts from farming are used in the first place to cover the growing cost of production. According to the observations of the Swiss Peasants' Secretariat, the cost of production of crops, not including the interest on capital amounted:

in the period 1901-05	to	£7 4s 5d	per acre
»	»	1906-12	» £8 8s 6d »
thus increasing by		£1 4s 1d or 17 per cent.	

In the year 1912 the cost of production reached £9 4s 2d, or a third more than in the period 1901-05.

The share in the cost of production due to the interest on the capital in soil is mostly much overvalued. Thus, for instance, the average cost of production of milk in Switzerland during recent years was about 7.98d per gallon; of this less than 0.86d is due to the interest on the land, and from 1.29 to 1.73d to the interest of the other capital invested in farming. An increase in the cost of production caused by the interest on the soil cannot be recognized from the results of the examination of the accounts kept.

On the other hand the outlay on interest, amortization and repairs of buildings has increased, and amounts now to 10.8d. The greater demands of labour have much increased the cost of production. Labour alone claims 3.24d per gallon of milk. Wages have increased by 22 per cent., while, thanks to the use of labour-saving appliances, the average amount of labour per acre is only 13 per cent. more than formerly. Further, the higher prices of concentrated foods and artificial manures, the greater consumption of which have favoured the greater intensity of farming, have contributed to raise the cost of production. Only through higher prices is it possible for farming to stand this increase in the cost of production.

Under the influence of better prices for his produce, the farmer has been able to attain better living. In farms which did not employ outside labour, the cost of living per man-day in 1901-05 was 11.12d and in 1906-12, 12.5d, or an increase of 1.38d or 12 per cent.

In the year 1912 it amounted to 13.25d.

In farms employing outside labour the cost of living has increased to a greater extent, being 14.25d. But as in this period the cost of articles of food has also risen, the nourishment has probably not changed much. On the other hand the other items of personal expenses have considerably improved per man unit and year. They amounted to £6 14s 10d in the period 1901-05, to £8 12s 1d between 1906 and 1912, increasing by £1 17s 3d or 27.7 per cent. In 1912 they reached £9 18s 3d.

Lastly, the higher incomes have allowed farmers to save more. On an average the savings per farm were £44 3s 4d between 1901 and 1905; £64 10s 11d between 1906 and 1911, an increase of £20 7s 7d or 46.1 per cent. and in 1912 they reached £80 1s 9d.

Only a very small part of these savings was invested in new capital proper, a certain amount was used for the paying off of debts, but more especially they were devoted to new installations in the farms, to the building of new outhouses, to the purchase of new machines and implements, to the increase of the live stock.

From the above it will be seen that the increased incomes of farmers, due to the higher prices of produce, benefited to a great extent other trades also, and that on the other hand a fall in the prices of produce with the usual cost of production would spell ruin to the farmers. If the whole debt of the agriculture of Switzerland, which amounts to about £150 000 000 were paid off, a fall in prices of one quarter would be enough to balance this advantage.

The gross produce of agriculture in Switzerland amounts at present to £37 070 000; three quarters of this, or in round numbers £28 000 000, are sold. The debt requires, at 4.5 per cent., about £6 700 000 for interest. The fall in prices would thus somewhat exceed the saving of interest.

With prices of produce lowered below the cost of production, the position of the peasants who had debts would not be improved but would be rendered worse, because the question of indebtedness is not so much a question of the price of land, which it is hoped to reduce by the introduction of lower prices of produce, as chiefly a question of the ratio between income and the rate of interest. So long as the agricultural net returns yield a higher rate of interest on capital than the interest that the peasant has to pay on his debts to the banks, the peasant with scanty capital can work in his farm with borrowed capital and still make a profit. On the other hand, when the low prices of produce cause the net returns from farming to sink below the rate of interest on loans, the peasant without sufficient capital or burthened with debts must end in ruin.

The most efficient method of solving the problem of indebtedness consists, according to the writer, in adopting in all transactions with farms, especially in the division of inherited land, their revenue as the basis of all valuation.

AGRICULTURAL INDUSTRIES.

1051 - Vinification by means of Ferments other than Wine Yeasts. — MARTINAND, V., in *Revue de Viticulture*, Vol. XLII, No. 1073, pp. 29-34. Paris, July 9, 1914.

From 1889 to 1901 the writer had studied the specific ferments of fine wines and of the grapes producing them, in collaboration with M. Rietsch; he has now isolated all the cellular ferments present on the ripe grapes of a celebrated wine. Among them are several micro-organisms which are not yeasts and which yield very little alcohol, but which impart a very agreeable fruity flavour absent from wines fermented only by the elliptical ferments.

To determine whether the Burgundy vineyards contain more of the elliptical ferments than those of the South of France, the writer repeated

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Pasteur's experiments in a vineyard near the Romanée-Conti property. Of 60 grapes, only one was found to contain elliptical yeasts; four apicular yeasts, two torulae, one fungal yeast (having the characters of both *Mycoderma vini* and a yeast) and six ferments causing turbulence in must, but capable of liquefying gelatine, were also found; the remaining micro-organisms were moulds, *Botrytis cinerea* and *Penicillium glaucum* being dominant; two tubes contained no micro-organisms capable of developing in must. The bacteria were not investigated in these experiments.

The fact that the true elliptical wine yeasts occurred on only one grape is in conformity with their general rarity in the vintage.

The organisms other than the elliptical yeasts produce little alcohol, but it does not follow that they are not able to utilise grape sugar. The evolution of carbon dioxide is not a sufficient index of the activity of the ferments of the grapes. Further, these organisms possess in different degrees the power of secreting diastases which dissociate albuminoid matter more actively than the yeasts. They are also able to free the must and wine more or less rapidly from any free sulphurous acid which they contain.

The following means of utilising these ferments in vinification is distinct from the use of selected yeasts and enables sulphurous compounds to be used when desired. Cultures of the selected ferments are made separately or mixed in must containing grape sugar, and they are supplied to vine-growers at the same time as the alcoholic yeasts. They are used as follows: a starter is prepared by cultivating the ferments in must and 20 litres of the must are used for every 100 h. litres of the wine; this must is allowed an incubation period of 24 hours. The starter is then added gradually as the must is put into the vat; the culture of elliptical ferments is added at the same time, without previous incubation. Twenty-four hours after the vat is full, a considerable quantity of must is drawn off from below and added above. Fermentation proceeds very rapidly and it is advisable to cool the floating grape-skins by spraying each morning with must from the bottom of the vat.

A culture of selected ferments other than those belonging to *Saccharomyces ellipsoides* has been employed; it does not produce more than 6 per cent. of alcohol. Another culture of alcoholic yeasts has been applied either to the starter of pure yeasts or direct to the vintage.

Sulphurous compounds, if used, should be applied only during the initial racking off and not on the grapes during fermentation. The amount should be less than in ordinary vinification, and it should only be used in the later racking if the temperature of fermentation rises too high, *viz.* above 35° C. (87° F.).

The writer considers that the selected ferments are used in large quantities in order to dominate the microflora, and the alcoholic yeasts added in less quantity are only able to complete the fermentation of the sugar to form alcohol. The micro-organisms of the selected cultures promote the activity of the alcoholic yeasts. The rapidity of fermentation prevents the growth of disease germs. Thus sulphurous compounds are unnecessary and are only added when the fermentation diminishes. Sulphurous acid gives

the wine considerable quality and by means of numerous comparative experiments it will be possible to limit or extend its use.

The writer points out the advantages to be derived from the use of selected ferments in connection with pure yeasts. The fresh fruity wines of the Beaujolais, as well as the Aramon wines from the South of France, much liked for this reason, will improve considerably when prepared by this method. The yeasts possessing a characteristic bouquet, like those of champagne, retain their quality in the presence of these selected ferments. The danger from a later fermentation in the bottle as in the case of sulphited wines, does not exist with wines prepared by this method of fermentation.

1052 - **Physico-Chemical Volumetric Estimation of Potash and Magnesia and its Application to Wines.** — DUBOUX, M., in *Comptes Rendus hebdomadaires des Séances de l'Académie des Sciences*, Vol. 159, No. 4, pp. 320-323. Paris, July 27, 1914.

M. Duboux proposes to extend the application of the electrical conductivity method (1) to the estimation of potash and magnesia, which had not yet been studied.

The potash is estimated in neutral solution after the addition of 18 times its volume of 95 per cent. alcohol by determining the conductivities after successive additions of platinic chloride. Magnesium is determined by the changes of conductivity of the solution to which 0.02 per cent. of ammonia and 0.06 per cent. of ammonium chloride have been added, induced by successive additions of a semi-normal solution of phosphoric acid. In estimating these substances in wines the organic matter must be previously removed.

The volumetric method gives results sufficiently consistent with those obtained by the customary gravimetric method, but generally about 0.01 gm. per litre below them.

1053 - **The Influence of Radioactive Emanations on Yeasts and Alcoholic Fermentation.** — JACQUEMIN, G., and GIUREL, G., in *La Vie Agricole et Rurale*, Year III, No. 35, p. 232. Paris, August 1, 1914.

Radioactive emanations have a marked action on alcoholic fermentation and yeasts, exerting a stimulating action from the moment of inoculation of the medium and the growth of the elliptical yeasts until the final stages. The transformation of sugar is more complete and the yield of alcohol is greater by several tenths of a degree in most radioactive media. A radioactivity of $\frac{1}{2}$ to 1 unit per litre exerts a beneficial action on yeasts and accelerates the breaking-down of saccharine organic compounds, just as in the case of the mineralization of nitrogen by nitrifying organisms.

The increased activity and alcohol-yielding capacity of radioactivated yeasts is of great advantage in many fermentation industries and notably in vinification.

(1) See article by P. DUTOIT and M. DUBOUX: "Analysis of Wines by a Physico-Chemical Volumetric Method". — *B.* Dec. 1912, pp. 2562-2569. Also, No. 947, *B.* Oct. 1914. (Ed.).

1054 — **Some Products of the Banana.** — *Queensland Agricultural Journal*, Vol II, Part 1, pp. 40-41; Part 2, pp. 150-152. Brisbane, July and August 1914.

It has been calculated that in all exporting countries there are probably 8 000 000 bunches of bananas that annually fail to come up to the standard required by shippers. These 8 000 000 bunches, at 6 *d* each, amount to £200 000 per annum. This shows the importance of the problem of their industrial utilization.

The writer describes the methods of preparing dried bananas, or "banana figs", banana meal, banana wine (obtained by the spontaneous fermentation of the fruit mixed with water, but which keeps only a short time), and banana alcohol or whisky. Bananas analysed by Corewinde showed that they contain as much as 22 per cent. of sugar, 16 per cent. of which is crystallizable; hence the conclusion that they might produce an excellent alcohol. At the Central Laboratory of Guatemala experiments were conducted which led to the production of a good spirit something like whisky. Samples of this spirit that had been only six months in the barrel were sent to the St. Louis Exhibition where they were much appreciated. The cost of manufacture is said to be much less than that of ordinary whisky. The yield may be estimated at about 1 gallon per bunch of bananas. The cost of a plant capable of producing 150 casks of whisky daily is estimated at about £34 500. This estimate includes buildings, machinery, apparatus, fuel, labour, administration, general expenses for two years, cases and bottles for one year and raw material for manufacture for two years, namely 270 000 bunches at 7 ½ *d* each.

1055 — **Studies on the Extraction of Olive Oil.** — VENTRE, JULES (*Ecole Nationale d'Agriculture de Montpellier*) in *Annales de l'Ecole Nationale d'Agriculture de Montpellier*, New Series, Vol. XIII, Part IV, pp. 249-269. Montpellier, April 1914.

I. — *Formation of the oil in the olive and its relation to the time of harvest and storage.* — Experiments were conducted to determine how far it is true that the yield of oil is increased by delaying the harvest of the fruits. The results are set forth in Table I and show that the increased yield of oil after maturity is only apparent, being due largely to loss of water by evaporation.

TABLE I. — *Composition of olives at various stages of maturity.*

	Date of gathering			
	November 15 unripe, skin of a yellow rose colour	December 3rd skin reddish	December 21 ripe and black not wrinkled	January 10 end of season fruit shrivelled
Weight of one olive . . . gms.	1.685	1.650	1.615	1.512
No. of olives per litre	350	392	420	458
Weight of 1 hl. kg.	58.975	64.680	67.830	69.250
Water in fresh olives . . . %	40.85	38.92	36.74	30.93
Oil in fresh olives %	17.2	20.85	24.16	25.63

In order to determine whether continued maturation on the tree influences the formation of oil, batches of fruits were stored in a dry atmosphere from the 15th of November to the 10th of January. The percentage of oil was determined at three different periods during this time and the results compared with the analyses of similar fruits gathered fresh from the trees at the same times as those taken from storage. The results are given in Table II.

TABLE II. — *Comparison between the oil-content of fresh olives and stored olives at different stages of maturity.*

Date of gathering or removal from storage	Stored olives			Fresh olives		
	Moisture % of fresh olives	% of oil in		Moisture % of fresh olives	% of oil in	
		fresh olives	dried at 105°		fresh olives	dried at 105°
November 15	—	—	—	40.85	17.2	29.1
December 3.	33.23	22.64	33.92	38.90	20.85	35.15
December 21	23.6	28.42	37.20	36.65	24.16	37.60
January 10.	20.62	30.48	38.40	30.92	25.63	37.12

It is seen that the proportion of oil to dry matter is sensibly the same in stored and freshly gathered fruits. On the 15th of November the olives contained 40.85 per cent. of water and on the 10th of January only 20.62 per cent.; by calculation from the 17.2 per cent. in the dry matter on Nov. 15, the stored fruits should contain 23.32 per cent. on Jan. 10, while the actual result obtained by analysis was 30.48, thus showing an increase of 7.16 per cent.

These results also show that harvesting the fruit too late diminishes the yield of oil. Olives may therefore be safely stored for a certain time provided they are placed in layers not exceeding 16 inches in thickness and the storeroom is kept ventilated.

Heated olives give a higher yield of oil. The best temperature is between 35 and 40° C. (95 and 105° F.) and is obtained by natural fermentation at the end of 6 to 8 days after storing according to the above conditions. Should spontaneous fermentation proceed too far, or if mouldiness appear, the oil will be acid and very inferior.

From these results the writer draws the following conclusions:

1. The yield of oil from olives increases from the beginning to the end of maturity, chiefly owing to the loss of moisture by evaporation and the consequent increase in the proportion of the other constituents.
2. The olive contains a sufficient quantity of reserve material to be transformed into oil during storage, and ripening may continue after harvesting the fruits as in the case of other fruits.

3. The best time for harvest is during the second and third periods of maturity, when the skin is red or black and without wrinkles.

4. Storage under rational conditions in no way endangers the quality and maturation of the fruit for industrial purposes.

II. — *Comparisons of mechanical and hydraulic presses.*

The results of experiments with the hydraulic press are given in Table III. Treatment A consisted in subjecting the paste of olives ground for half an hour on a small mill stone, to a maximum pressure of 260 000 lbs. maintained for 80 minutes. The oil thus obtained was of superior quality.

Treatment B consisted in subjecting the paste to a preliminary pressure of 150 000 lbs. for 25 minutes, after which the baskets were emptied and the paste placed in the finishing press, taking care to add 2 litres of warm water at 80-85° C. to each basket. The pressure was then raised to 260 000 lbs. for 55 minutes. The liquid of the different pressures was collected separately; the first was of fine quality, the second had a less agreeable dry taste.

Treatment C was exactly similar to the preceding, with the difference that the water used was at a temperature of 15° C. The separation of the watery layer was more rapid than in the preceding case and the second oil extraction was considerably improved; it was considered advisable to mix the two qualities of oil and obtain a unique product of superior quality. Treatment D differed from B and C in omitting the addition of any water to the pressed paste. The quality of the oil obtained at both pressures was superior to that obtained by treatment B.

Treatment E was like treatment B, but the duration of the pressure was doubled, 40 minutes in the preliminary press and 80 minutes in the final press. The product obtained in this case was inferior to all the preceding.

Table III shows that the yields were almost equal by each method, excepting the slight increases when water was added.

The use of cold water, which does not injure the product, should not be neglected in large factories.

The experiments of which the results are summarised in Table IV were conducted in a mechanical lever press, with a pressure of about 167 000 lbs. The procedure was analogous to that of the preceding experiments; in A the pressure was maintained for 100 minutes, in E each pressure was applied for 1 hour.

Comparing Tables III and IV it is seen that the yield of oil from the first operation is greater with mechanical presses than with hydraulic, but the total yield of oil is greater from the latter.

The residues of the two series of experiments were analysed. The Table shows that the residues of the first series (hydraulic presses) contain in the average of the treatments 10.16 per cent. of oil (in terms of dry matter), whilst the residues of the second series (mechanical presses) contain 11.59 per cent.

It was observed during these experiments that the degree of grinding

TABLE III. — *Experiment with hydraulic presses.*

		Treatment				
		A.	B.	C.	D.	E.
Yield of oil per 100 kg. of fresh olives.	1st Pressure (preparatory).	—	14.95	15.1	14.8	13.05
	2nd Pressure (final):					
	a) without water	16.85	—	—	2.1	—
	b) with warm water	—	2.50	—	—	2.35
	c) » cold water.	—	—	2.2	—	—
Total . . .		16.85	17.45	17.3	16.9	17.40
Percentage of total oil obtained.	1st Pressure	—	70.7	71.4	70.0	71.15
	2nd Pressure	79.7	11.8	10.4	10.0	11.1
Residue, % of fresh olives		42.1	43.7	40.4	46.3	43.8

TABLE IV. — *Experiment with mechanical presses.*

		Treatment				
		A.	B.	C.	D.	E.
Yield of oil per 100 kg. of fresh olives.	1st Pressure.	—	15.75	15.95	15.80	16.13
	2nd Pressure :					
	a) without water.	16.2	—	—	0.55	—
	b) with warm water	—	0.85	—	—	0.72
	c) » cold »	—	—	0.45	—	—
Total . . .		16.2	16.60	16.40	16.35	16.85
Percentage of total oil obtained	1st pressure	—	74.47	75.36	74.7	76.20
	2nd pressure	76.6	4.00	2.13	2.6	3.46
Residue, % of fresh olives.		59.9	54.4	57.1	54.3	53.4

has no essential importance with respect to yield of oil, and that if it is too extreme the yield is actually diminished.

The conclusions drawn from these experiments are :

1) Hydraulic presses are always capable of excellent returns, with regard to both yield and economy of time.

2) Mechanical presses, when well made, can yield almost as good results as hydraulic presses under certain conditions.

3) Hydraulic presses should be employed in large installations where the increased yield will compensate for their heavy expenditure.

4) Apart from the pressure, the addition of hot or cold water results in an increased yield.

5) As a general rule the yields obtained by the use of cold water are about equal to those obtained by hot water.

1056 - **Some Data on Peanut Butter** (1). — Urr, C. A. A. (Kansas State Agricultural College, Manhattan) in *The Journal of Industrial and Engineering Chemistry*, Vol. 6, No. 9, pp. 746-747. Easton, Pa., September 1914.

The writer analysed 23 samples of peanut butter bought on the Kansas market and found that the percentage of oil varied between 46.44 and 53.64. The refractive index at 25° C. ranged from 1.4680 to 1.4707 and the iodine value from 88.76 to 94.36. He further prepared three samples of roasted peanuts reduced to butter-like consistency and found their characters to be within the above limits. Another sample was prepared by roasting peanuts brown in olive oil and then grinding them as finely as possible. It was found to contain 55.48 per cent. of oil and its refractive index was 1.4620.

According to BEATTIE some fresh peanuts may contain as much as 50 per cent. of oil; after roasting the oil content would be higher owing to a corresponding loss of water. The writer concludes that finding more than 50 per cent. of oil in peanut butter does not warrant its being declared adulterated by the addition of other oil. That added oil can be detected is seen in the lowering of the refractive index by the use of olive oil.

1057 - **The Japanese Seaweed "Tosaka Nori."** — COTTON, A. D., in *Royal Botanic Gardens, Kew, Bulletin of Miscellaneous Information*, No. 6, pp. 219-222. London, 1914

Professors Cotton and Yendo have identified and named *Eucheuma papulosa* the edible Japanese alga known in Japan as "tosaka nori", and which had been described under several other names. It is found in the Red Sea, and in the seas near Somaliland, Formosa, Japan, Guadeloupe and the Sandwich Islands. In Japan it is much esteemed. It is often collected by divers in a depth of 10-12 fathoms along open coasts in the middle and southern parts of the country. Large quantities of the plant are, however, obtained by picking up the floating fronds with scoop nets after rough weather in early spring. The weed is dried in the sun and sold in the markets. It is prepared into isinglass and is used as food. A certain amount is also exported annually to China, where it is known as "hong-tsai" (crimson weed).

1058 - **Bacteriological Enquiry on Sterile Milk Sold in Brussels.** — KUFFERATH, H., in *Annales de Gembloux*, Year 24, Bk.8, pp. 417-424. Brussels, August 1914.

From the results of 17 samples the writer draws certain conclusions concerning milk sold as "aseptic" in Brussels. Comparing the results obtained by the use of aseptic milking with those already published on the ordinary milk delivered in the city of Brussels, the progress made by dairymen becomes apparent. The writer had found that the ordinary milk contained on an average 1 388 430 germs per cc., whilst in the 17 samples above mentioned only 17 263 germs per cc. were found. These results show the importance of the establishment of official bacteriological control for milk supplies and the value of such a service to the public.

Of the 17 samples examined, two were found to contain *coli* bacilli. Sterile milk should be such that it may be safely consumed without boiling. It is therefore evident that the greatest care should be taken to observe strictly all regulations.

The Belgian Permanent Milk Commission asked the writer to determine a maximum limit for the number of germs allowable in sterile milk. This standard should be about 50 000 germs per cc., estimated by counts on gelatine plates kept for 3 days at a temperature of 38° C. At the same time no injurious bacilli such as *coli* and tuberculosis germs must be allowed.

1059 - **Payment for Milk and Cream Supplies.** — CUDDIE, in *The Journal of Agriculture*. Vol. VIII, No. 3, pp. 295-299. Wellington, N. Z., March 1914.

While the purity of milk (that is the lowest possible content of micro-organisms) is of the greatest importance for making cheese and butter of the very best quality, milk supplied to dairies continues to be paid for according to fat content alone. As all the lots of milk are mixed and worked up together the least pure lots reduce the best to a lower common standard, and the injury caused only by the least careful dairy farmers is felt equally by all.

The official inspection of milking sheds, yards, etc., has only a partial success in raising the standard of purity in factory supplies. The writer therefore proposes that a reduced price per pound of butter-fat be paid for those quantities of raw material which can yield produce of only indifferent quality, and a premium be given for those deliveries which possess a high degree of purity.

In order to introduce such a scheme it would, of course, be necessary to have the milk and cream from each farm classified by a competent and independent officer, who would visit the factory for the purpose, not less frequently than once a week. The date of his visit should not be known to the suppliers.

A sample representative of the day's supply should be taken on the day of the officer's visit and submitted to the "curd test".

This test has been tried over a long period of years and has been found to be thoroughly reliable as an indicator of the purity of the milk, although it does not appear to have ever been applied to the grading of milk for payment purposes.

The samples submitted to the grading officer for examination need bear only a number and not the name of the owner. The grader would record his decision and hand a copy of his results to the secretary of the company concerned, who would credit each supplier with the grade recorded for that particular period. The number of days covered by this test might be made coincident with the period covered by the test for butter fat, which would simplify the work.

The men selected to undertake the grading should be appointed by Government. If the work were properly organized, in most districts several neighbouring factories might agree to have the same inspector, which would make the expense to each very moderate.

The writer is convinced that the adoption of the scheme outlined above would eventually raise the value of New Zealand butter and cheese by at least 3s or 4s per hundredweight. In fact the best New Zealand cheese exhibited at the last Dunedin Winter Show and then sent to London, where it was placed on exhibition, was sold 4 to 5 s per cwt. more than New Zealand cheese was bringing on the market at the time.

1060 — **The Influence of Foot-and-Mouth Disease on the Composition of Milk and Butter.** — BORDAS, F., and DE RACZKOWSKI, S., in *Annales des Falsifications*, Year 7, No. 68, pp. 271-292. Paris, June 1914.

After giving a résumé of the question which has interested the chemists and magistrates appointed for the suppression of frauds (1), the writers furnish additional information for the solution of this problem. The researches were made with samples of milk taken with all possible care in the presence of the local veterinary surgeon in places where foot-and-mouth disease had been reported. The results of the analyses of diseased and healthy milk from the same cowsheds have been compared with the average obtained the same day from milk collected throughout the district.

The changes in the composition of the milk and butter due to this disease are as follows:

1) *Milk.* — A notable increase in the proportions of fat and mineral salts, especially chlorides, and a decrease in the percentage of casein. There is apparently no change in the percentage of lactose, except that in the case of milks from cows in the height of fever and of those with abnormally high fat content there is a decrease in lactose accompanied by a corresponding increase in ash. The percentage of organic phosphorus and the acidity remain unchanged. Milks in which solids-not-fat fall below 86 gms. per litre are rare.

2) *Butter.* — Examination of butter from a single badly diseased cow might lead one to suspect addition of about 25 per cent. of margarine, whilst that from a herd of cows more or less infected would be suspected of an addition of 5 to 6 per cent. The conclusions of the writers confirm those put forward by French Analysts.

Thus, though it is true that the milk from a single cow or a small number of cows in the same shed, or that the butter obtained from a small quantity

(1) See No. 2783, *B.* Aug.-Sept.-Oct. 1911; No. 954, *B.* Aug. 1913.

(Ed.)

of infected milk may show an abnormal composition, the collected milk or the butter centrifuged from it never show any defects such as would make them unsaleable.

1961 - New Observations on the Origin of the Taste of Swedes in Butter. — WEIGMANN and WOLFF, in *Landwirtschaftliche Jahrbücher*, Vol. 46, Part 3, pp. 343-365. Berlin, May 15, 1914.

In the 37th volume of *Landwirtschaftliche Jahrbücher* one of the writers demonstrated that the taste of swedes in butter is to be attributed, for the most part, to bacterial action and only for the very least part to a somewhat stronger smell and taste of the cow than is found in ordinary milk. He further recognized that the bacteria which caused this secondary flavour are not new and special ones, but those which are generally found in milk, especially *Bacterium coli*, lactic acid bacteria, *Actinomyces odorifer*, besides some mycelia rarely found in milk.

Since the above publications the writers studied further cases of the taste of swedes in samples of milk and butter. It was first established that the swede flavour was due to strains of *B. coli* together with other species, among which is to be mentioned *Bacterium fluorescens liquefaciens*, which possesses to a great degree the power of producing the taste of swedes and of carrots in milk. The observations on the latter taste were made on the occasion of investigating a milk which was designated as "bitter" and subject to "premature curdling", in which this bacterium was prevalent together with members of the *coli-aerogenes* group, short alkaline bacilli and cocci. The glass plates on which the milk was laid smelt distinctly and strongly of carrots, and the milk inoculated with the isolated bacteria took after 24 hours the same strong taste and smell.

The taste of swedes caused by *Bacterium fluorescens liquefaciens* is exceedingly acute and strong, and could be studied in a number of cases. In several occasions, when the above bacterium was present, instead of the swede taste a fine pineapple or strawberry flavour could be detected. In other instances the *Bacterium fluorescens* did not produce the swede taste when alone but only in the presence of other bacteria, especially of lactic acid bacteria. The latter alone may even be the cause of the defective taste of the milk, from which it follows that they also are capable of giving the swede taste to butter. This is perhaps rather more a taste of "fodder", which becomes stronger and more distinctly swede-like as soon as other bacteria or fungi possessing similar properties are present.

In all the cases mentioned the writers have found bacteria which possess the power of producing such tastes and odours. It may thus be inferred that the substances giving these tastes and odours are due to properties of the bacteria acquired during their evolution, which properties the writers attribute chiefly to the nutritive medium or to the medium in which the bacteria live.

The experiments made, show that these odorous substances of the nutritive medium are partly directly transmitted and are partly due to the production of substances which do not exist in the nutritive medium but are formed from the components of the medium. It may be admitted

as certain that every group and species of bacteria has its specific action as to taste. Whether the same nutritive medium under the action of different bacteria gives rise to the same taste remains to be investigated.

1062 - **The Odessa Cattle and Meat Supply.** — *Daily Consular and Trade Reports Issued by the Bureau of Foreign and Domestic Commerce, Year 17, No. 196, pp. 1004-1005. Washington, August 21, 1914.*

The Russian cattle industry is continuously declining and the meat producing centres are gradually receding to the outskirts of the country; nevertheless there is no scarcity of forage and the breeds are improving considerably, as has been shown by the recent livestock exhibition at Petrograd. There were no oxen weighing less than 542 lbs. and some weighed as much as 1264 lbs.

During the last three years the following animals were slaughtered at the Odessa abattoir :

	1911	1912	1913
Cattle	132 566	119 397	125 474
Calves	26 522	25 412	26 343
Sheep	68 963	84 911	88 114
Lambs	46 935	43 159	53 398
Swine	41 825	53 924	61 797

Cattle and other animals intended for consumption must be killed and prepared at the city abattoir. Only such animals as have been inspected by its veterinary surgeons are allowed to be killed, and after slaughter the meat is again inspected as well as all prepared meat brought into the city. All meat intended for exportation must also be accompanied by a certificate from the veterinary of the National Government. A small quantity of meat is sent from Odessa to other Russian ports on the Black Sea.

The Odessa cattle market, the largest in South Russia, supplies many neighbouring towns and determines the prices of meat animals for a wide radius. In 1913 the following animals were brought to the Odessa market : oxen 39 965 ; cows, 48 286; heifers 76 464; calves 1556. Most of the cattle and meat supply of the city is brought from within a radius of 200 to 300 miles.

The following table shows the average wholesale prices per 100 pounds of various meats during the last three years :

Years	Beef	Veal	Mutton	Pork
1911	\$ 7.75	\$ 15.00	\$ 6.80	\$ 8.30
1912	8.00	15.75	8.55	8.90
1913	7.80	15.00	7.50	8.50

The retail price of beef has risen during the last seven years from 7.2 cents per lb to 11.1 cents.

In considering these prices it must be remembered that the animals are not of improved breeds and that the method of cutting up provides the buyer with much waste.

Much attention is given to the treatment of by-products at the city abattoir. The blood is mostly dried and powdered. The entrails are used chiefly for feeding swine and fowls. The intestines are worked up locally into sausage casings and musical instrument strings, and occasionally small quantities are salted for export. Most of the fat is used in the local industries, especially that of soap making, partly also in the manufacture of margarine. Some mutton fat is exported to Turkey. Hoofs and horns are for the most part worked up by factories in Central Russia. Almost all the hides go to local tanneries. The contents of stomachs are desiccated and carted to the Odessa irrigation fields, where they are ploughed into the poorest soils, which are a mixture of brackish sea sand and clay carried down by the rains.

When amply manured, treated with the city's waste waters and cleared of salt, the ground is good for kitchen-garden produce.

1063 - **The Wool Clip in Australasia in the Year 1913-1914.** (1) — *The Agricultural Gazette of Tasmania*, Vol. XXII, No. 7, p. 254. Hobart, July 1914.

The number of sheep estimated to have been shorn in the Commonwealth and New Zealand in the season 1913-14 was 109 692 264 head, including lambs, and they produced 7.87 lbs. per fleece as against 7 lbs. for the previous season. An average monetary return of 6s 4d per head was realized, the total value of the wool clip being £34 957 463. The overseas exports of wool, plus the quantity retained for manufacturing purposes, give a total of 2 639 280 bales. The average sale price per bale was £13 4s 11d and the total amount of all the wool sold in Australia and New Zealand was 1 968 578 bales, while 10 years ago only 837 497 bales were sold. The increase in the value of the wool clip sold in Australasia in 10 years amounts to no less than 160 per cent.

(1) See also No. 837, *B.* July 1913 and No. 1119, *B.* Oct. 1913.

(Ed.).

PLANT DISEASES

GENERAL INFORMATION.

LEGISLATIVE
AND ADMINI-
STRATIVE
MEASURES

1064 - Decree of the Governor of the Colony of Eritrea, dated 13 July 1914, (No. 2026), concerning the Protection of Plants. — *Bullettino ufficiale della Colonia Eritrea*, Year XXIII, No. 29, pp. 221-222. Asmara, July 16, 1914.

Art. 1. - Proprietors and directors of horticultural establishments and nurseries in Eritrea producing plants, parts of plants and seeds, or engaged in their sale, are required to declare this to the regional commissioner.

The Colonisation Department has the right to inspect crops and vegetable products wherever they may be stored, and, if they are considered infected, to prevent their sale or order their disinfection.

Art. 2. — Officers acting under the instructions of the Director of the Colonisation Department have the right of entry into all properties, irrespective of the crop or use of the land, to ascertain whether diseases are present, and according to the provisions of this decree and special enactments, they have the power to take the necessary steps for the disinfection and care of infected plants.

Art. 3. — The introduction of agricultural, forest and ornamental plants and parts of plants or seeds from Italy is forbidden, unless they are accompanied by a certificate indicating their origin and declaring them to be free from plant diseases liable to endanger the production of crops or useful wild plants in the Colony.

Art. 4. — The certificates referred to in the preceding article should be signed by the Directors of the State Phytopathological or Entomological Stations or Laboratories, or by the Directors of State Institutes or Experiment Stations authorised to grant such certificates.

Art. 5. — The importation of plants, parts of plants and seeds from foreign countries is in general forbidden. In exceptional circumstances the Colonisation Department will be able to grant special permission for the introduction of plants, parts of plants and seeds from foreign countries when certified to be free from dangerous diseases by competent persons appointed by the Department itself.

Art. 6. — Plants not considered free from diseases dangerous to the cultivation of crops or economic plants in the Colony will be destroyed without any compensation being allowed to the owner. The destruction of plants is placed under the charge of the Director of the Customs Office.

Art. 7. — Contraventions of this decree or of regulations to be published for the execution of the decree are punished by a fine of from 8s to £4, without excluding more serious penalties for violations of provisions of the Italian Penal Code. Contraventions of the prohibition of importation and conveyance shall be liable to a penalty not less than 8s and not exceeding £12, without excluding more serious penalties for contraband.

Art. 8. — On the proposal of the Director of Colonisation, special dispositions concerning the following matters may be published :

a) destruction of stubble and crop refuse liable to endanger the cultivation of other crops in the Colony;

b) prohibition of growing certain crops or of certain methods of cultivation liable to cause damage to cultivated or wild plants of economic value to the Colony;

c) prohibiting cultivators from allowing plantations of trees to be neglected if they are attacked by injurious parasites ;

d) enforcing definite treatment for the disinfection of plants, parts of plants and seeds introduced into the Colony ;

e) enforcing the use of remedies and the means of control against plant diseases, injurious insects and other plant pests, in cases in which the efficacy of the above measures depends upon the cooperation of all interested, and in cases of neglect to observe these orders, the carrying out of the necessary treatment at the expense of the defaulters.

Art. 9. — Special decrees will be introduced concerning the publication of provisions which may be required for the control of specially injurious pests or for the more effective protection of special crops.

DISEASES NOT DUE TO PARASITES OR OF UNKNOWN ORIGIN.

1065 — **The Contortion and Breaking of Wheat Straw.** — DARNELL-SMITH, G. P., in *The Agricultural Gazette of New South Wales*, Vol. XVI, Part 5, pp. 377-378, 1 fig. Sydney, 1914.

In several districts of New South Wales, especially at Nyngan, Wagga and Cowra, it has been observed that wheat is subject to a malformation or twist of the stem as though its normal development had been restrained. The stem is thus weakened and is liable to be broken by the wind when the grain is ripe. In some cases this is so common that the crop appears to have been trampled under foot.

The natural strength of the straw does not appear to have any considerable influence on the prevalence of this phenomenon. In explanation it has been suggested as being caused by insect attacks and also by disproportionate growth of the stems.

Similar cases were also recorded at Carrathool and Deniliquin in 1900, and in the former place it was said to be caused by the bites of aphides during the early stage of growth.

Examination of the diseased straws in 1912-13 did not show the presence of any insect or fungus disease, nor were aphides found on the wheat at Nyngan, Wagga or Cowra in 1914.

According to Maiden, the Government Botanist, who examined several stems, the centre of the disturbance is situated near the lower nodes of the stem. He also remarks that a similar phenomenon has been described as "contortion" by Masters and according to him it is generally produced by retarded growth in certain directions or abnormal growth in others.

Unfortunately, neither attacks of aphides nor abnormal growth due to irregular rainfall admit of the application of remedial measures.

BACTERIAL AND FUNGOID DISEASES.

GENERALITIES

1066 - Parasitic Fungi collected in the Straits Settlements and Fiji Islands. — Royal Botanic Gardens, Kew, *Bulletin of Miscellaneous Information*, 1914, No. 4, pp. 156-159. London, 1914.

Among the 11 species enumerated, the following described by Massee as new to Science are worthy of mention from a phytopathological point of view: 1) *Cyphella Heveae* collected in Province Wellesley on the bark of *Hevea brasiliensis* and undoubtedly parasitic on this plant; it is allied to *C. villosa* Karst.; 2) *Botrytis necans* observed in the Botanic Gardens at Singapore on the larvae of *Brachastoma catoxantha* (Lepidoptera), which is effectively kept in check thereby; 3) *Cercospora Musae* parasitic on the leaves of bananas in the island of Viti Levu (Fiji). It is considered to be the cause of a serious disease in estates in the Sigatoka district. Infected leaves fall early: generally the lowest leaves are attacked first and the disease spreads upwards.

FUNGI

1067 - The Presence of the Hybernating Mycelium of *Macrosporium Solani* in Tomato Seed. — MASSEE, I., in *Royal Botanic Gardens, Kew, Bulletin of Miscellaneous Information*, 1914, No. 4, pp. 145-146, 1 plate. London, 1914.

It has long been suspected that the spores of "black rot" of tomatoes (*Macrosporium Solani* Cke.) were contained in the seeds, but the actual presence of the fungus had not yet been demonstrated. When the fruits are attacked by the fungus the seeds show black spots on their surface. In 1906 G. Massee showed that the plants derived from such infected seeds were often attacked by "black stripe" disease of the stem due to *M. Solani*. Microtome sections of these spotted seeds show the presence of the mycelium of the fungus.

In a healthy tomato seed, the external integument is in intimate contact with the endosperm, whilst in an infected seed there is a thick layer of hyphae between the two.

In the case of badly damaged fruits the mycelium extends below the diseased zone and in many cases the placentas are completely invaded by a thick web of mycelium, which renders them quite black. The seeds attached to these placentas are often attacked by the mycelium, which penetrates the micropyle. The web of mycelium sometimes forms a uniform layer round the endosperm; in other cases it is of variable thickness or only represented by local patches. The hyphae extend from the periphery to the endosperm and also to the embryo, probably dissolving the thin cell-walls by means of a ferment. When the end of a hypha comes in contact with a cell-wall, it flattens and swells, a small portion of the centre then penetrates the cell-wall and swells out on the other side to its normal size. In other cases the penetration of the hyphae is effected without the flattening and swelling out. No haustoria are found.

On the germination of infected seeds, the embryo is destroyed almost immediately by the mycelium if it is present in quantity, or the mycelium continues to grow in the tissues of the young plant where it may easily be found. Infected plants show the "black stripe" disease before they are two months old, if grown under favourable conditions for the growth of the fungus. Sections of diseased seeds which had been kept dry for several months became surrounded by a mass of mycelium when placed on damp filter paper in a Petri dish, thus showing that the mycelium retains its vitality for a considerable time inside the seed. In numerous cases when the seed from a diseased fruit does not contain mycelium in its interior, it is surrounded on the exterior by a web of mycelium which cannot be removed by the ordinary processes of cleaning, since it is held in position by the thick layer of hairs on the seed-coat.

This external mycelium is therefore a source of danger. The only certain means of avoiding the disease is by rejecting all seeds produced by diseased fruits, even those which do not show black spots.

1068 — **The Resistance of Different Varieties of Gooseberries to American Gooseberry Mildew (*Sphaerotheca mors-uvae*) and the Effect of Treatment with Sulphur.** (1) — KÖCK, G., in *Zeitschrift für das Landwirthschaftliche Versuchswesen in Oesterreich*, Year XVII, Part 6-7, pp. 634-637. Vienna, 1914.

During 1913 the writer had the opportunity of studying the resistance to American gooseberry mildew (*Sphaerotheca mors-uvae*) of some hundred varieties of gooseberries, at Eisgrub (Bohemia). The effect of sulphuring (with "Ventilato") was also observed.

This rich collection of gooseberries was examined on July 15th and it was found that of the red varieties the following were attacked by the disease: Chain Red, Drum Major, Guido Red, Overall, Raspberry and Roaring Lion (or Rote Preisbeere); on the occasion of a second visit on August 5th, Monstrueuse (or Rote Preisbeere) was found to be diseased. Of the green varieties the following were infested on July 15th: Duke of Bedford, Green Walnut, Keepsake, Plain Long Green, Smiling Beauty

RESISTANT
PLANTS

(1) See also No. 884, *B.* July 1913; No. 1301, *B.* Nov. 1913; No. 183, *B.* Feb. 1914. (Ed.).

(Hellgrüne Samtbeere). The following yellow varieties were found diseased on July 15th: Globe Yellow (or Runde Gelbe) and Rockwood, whilst Yellow Lion was found diseased on August 15th. The only white variety attacked was Queen Mary.

Sulphuring caused leaf-fall in the following 56 varieties:

Aaron, Alexander, Antagonist, Apollo, Britannia Red, Chain Red, Champagne Yellow, Companion, Conquering Hero, Drum Major, Duckwing, Fleur de Lys, Frühe Weisse, Früheste von Neuwied, Green River, Grosse Rauhe Rote, Guido Red, Husbandman, Industry (or Rote Triumphbeere), Jaune Rouge, Jolly Miner, Jolly Printer, Keen's Seedling, Large Hairy, Leveller, Liberator, Migolez (or Red Walnut), Minima, Monstrueuse, Mount Pleasant, Oakmere, Overseer, Pitmaston Green, Platttrunde Himbeerstachelbeere, Pride, Prince of Orange, Prince Regent, Printer, Queen Caroline, Raspberry, Roaring Lion, Rockwood, Rose of Sharon, Rough Red, Sämling von Maurer, Sämling von Pausner, Sampson, Shannon, Smiling Beauty, Smith's Improved, Smooth Yellow, Teazer, Twigem, White Champagne, Yellow Eagle, Yellow Lion.

The following varieties resisted infection:

1) *Red*: Alicant, Alexander, Britannia, Bloodhound, Companion, Forester, Grosse Rauhe Rote, Industry, Jaune Rouge, Jolly Miner, Jolly Printer, Keen's Seedling, London, Migolez, Octavius Brown (Dans Mistake), Platttrunde Himbeerstachelbeere, Rough Red, Rose of Sharon, Sämling von Maurer, Twigem, Wonderful (Braunrote Riesenbeere), Ironmonger.

2) *Green*: Balloon, Aaron, Bumper (Rockwood), Emerald (Smaragdbeere), Früheste von Neuwied, Green Willow (Grüne Flaschenbeere), Green Yellow Seedling (Golden Lion), Green River, Independent, Jolly Angler (Grüne Riesenbeere), Lovely Anne, Lofty (Grüne Riesenbeere), Nettle Green (Dünnschalige), Pitmaston Greengage, Smith's Improved, Thumper, Frühe Weisse Hebbun, Green Prolific, Lady Delamere.

3) *Yellow*: Britannia, Catherina, Conquering Hero, Champagne Yellow, Duckwing, Golden Yellow (Marmorierte Goldkugel), Höning's Früheste (Früheste Gelbe), Husbandman, James Dawson Yellow, Liberator, Leveller, Lord Randiffe, Minima, Prince of Orange, Printer, Rumbullion, Reveller, Smooth Yellow, Sampson, Triumphant, Two-to-one, Teazer, Yellow Eagle, Mount Pleasant, Stella.

4) *White*: Antagonist, Apollo, Date, Eagle, Fleur de Lys, Large Hairy, Primrose, Queen Caroline, Sämling von Pausner, Shannon, White Lion, White Champagne, Whitesmith.

The following showed no leaf-fall after treatment with sulphur:

1) *Red*: Alicant, Bloodhound, Forester, Over-all, Octavius Brown, Ironmonger.

2) *Green*: Balloon, Bumper, Emerald, Green Willow, Green Yellow Seedling, Green Walnut, Independent, Jolly Angler, Keepsake, Lovely Anne, Lofty, Nettle Green, Plain Long Green, Thumper, Duke of Bedford, Green Prolific, Lady Delamere.

3) *Yellow*: Britannia, Catherina, Globe Yellow, Golden Yellow, Höning's Früheste, James Dawson Yellow, Lord Ranciffe, Rumbullion, Reveller, Triumphant, Two-to-one, Stella.

4) *White*: Date, Eagle, Primrose, Queen Mary, White Lion, Whitesmith.

The observations concerning the disease resistance of each variety and the action of sulphur on the leaves will be continued.

- 1065 - On the Composition of Alkaline Bordeaux Mixtures and their Soluble-Copper Content. — VILMOREL, V., and DANT NY, E., in *Comptes rendus hebdomadaires des séances de l'Académie des Sciences*, 1914, 2nd Half-year, Vol. 159, No. 3. pp. 266-268. Paris, 1914

MEANS
OF PREVENTION
AND CONTROL

According to some authorities, the insoluble copper exists in Bordeaux mixture in the form of hydrate: according to others it is also present in the form of basic sulphates and double sulphates of calcium and copper. This work was carried out to determine the conditions of formation of these different compounds and to determine whether alkaline mixtures are free from soluble copper.

It was found that acid mixtures, apart from the free copper sulphate, consist almost entirely of the basic sulphates of copper of green colour to the exclusion of the hydrates of copper, whatever their mode of preparation. The precipitate has no immediate action on neutral solutions of ferrous sulphate.

Further, experimenting with exactly determined equal proportions of copper sulphate and lime, it is possible to produce two alkaline mixtures absolutely different, one being blue and the other green. On adding an excess of lime to a solution of copper, the blue hydrates or green basic sulphates of copper are produced according to the rapidity with which the lime is poured in. When hydrates are formed, they consist chiefly of the stable hydrate of Pélégot.

The quantity of copper in solution in blue alkaline mixtures, valued as sulphate, may reach 23 gms. per hl., but it diminishes on keeping. Besides the copper thrown out of solution, green alkaline mixtures contain both lime and copper compounds in solution; the proportion of copper valued as sulphate reaches 41 gms. per hl. but diminishes on keeping.

It follows that alkaline mixtures, contrary to the general opinion, always contain some copper in soluble form; and this amounts to about 2000 to 4000 times the amount required to prevent the germination of the spores of *Plasmopara viticola*. Consequently the objections to this mixture are unjustifiable.

- 1070 - Potato Diseases in Victoria, Australia. — BRITTELBANK, C. C., in *The Journal of the Department of Agriculture of Victoria, Australia*, Vol. XII, Part 7, pp. 400-403. Melbourne, 1914.

BACTERIAL
AND FUNGOID
DISEASES
OF VARIOUS
CROPS

Since 1911, Victoria has, so far, been fortunate in not having to record any of the more serious diseases affecting potatoes in Europe and other countries. The only new disease, and one possibly of minor importance, is that commonly known as "dry scab" (*Spondylocladium atrovirens* Harz). Neither the "corky or powdery scab" (*Spongopora subterranea* [Wallr.] Johnson) nor "black wart disease" (*Synchytrium endobioticum* Percival) has yet made its appearance in this country. The former has, however, been detected in two separate shipments of potatoes from Europe, both being confiscated and destroyed.

From the serious nature of these diseases it would be as well, before too late, to prohibit totally and absolutely the importation of potatoes into Victoria from countries beyond the Commonwealth. Varieties suitable to the climate could be raised within the State, from seed either im-

ported from abroad or raised here. By adopting this course the danger of introducing either of the above diseases would be minimised.

During the past three years, examination of the consignments of potatoes from various countries, revealed the universally diseased condition of the tubers. Not a single consignment was free from disease. The following diseases were found to occur in one shipment alone: *Spongospora subterranea* (Wallr.) Johnson, *Phytophthora infestans* De Bary, *Rhizoctonia Solani* Kühn, *Spondylocadium atro-virens* Harz, *Fusarium oxysporum* Schlecht., *Oospora Scabies* Thaxt., *Bacillus Solanacearum* E. F. Smith.

1071 - Fungus Diseases of Hevea in the Belgian Congo. — VERMOESEN, in *Bulletin agricol du Congo belge*, Vol V, No. 2, pp. 312-321. Brussels, 1914.

During a stay at Bakusu, Coquilhatville, in the Belgian Congo, in January 1914, the writer examined the Hevea plantations for fungus diseases.

Only a single case of root-disease was found; probably the freedom from disease of the roots was due to the plantations being on a deep, well drained, sandy soil, as well as to the fact that the land was almost wholly cleared of trunks and stumps, which favour the spread of *Fomes semitostus* and other root parasites: it should be noted that this *Fomes* was found on two stumps.

The "die-back" disease of branches and trunk is very widespread at Bakusu. In the nurseries the damage is slight, only the tips of the branches being attacked generally, though in exceptional cases the main stem may be killed. The worst damage is just after planting out, when many trees succumb. In older plantations it is chiefly the younger branches which are attacked, the result being weakening of the tree.

The disease normally appears at the tips of the green branches, from which it works its way towards the base of the stem. On the bark appears a pale brown patch bounded by a sharp line, while the wood turns blackish grey. The infection often stops when it reaches the junction with a larger branch and almost always at the trunk. On old branches the disease is recognized by the loss of the leaves, in conjunction with the change of colour of the wood. The fruiting-bodies of the fungus causing the disease also appear: it is probably referable to *Diplodia cacaoicola*, which attacks Hevea, cacao, etc., in various tropical countries.

A few other parasites of no practical importance were noted, viz. a fungus near *Hypocrella* and an alga (*Cephaleuros*) on the leaves, and *Gloeosporium* sp. and a fungus belonging to the Hysteriaceae on the twigs.

Root-disease should be combated by burning all wood infected by *Fomes semitostus*, as well as stumps and dead branches. Care should be taken not to spread infected earth about, and after an infected tree has been removed the earth should be turned over to expose it well to the sun; lime may be added if obtainable; in any case fresh trees should not be planted for five or six months.

"Die-back" may be dealt with by spraying the young trees in the nursery with Bordeaux mixture; infected twigs or trees should at once be burnt. Older plantations should be gone over at least every two months to cut out infected wood. Vegetable tar should be applied to all wounds.

1072 — **Fungus Diseases of Cacao in the Mayumbe, Belgian Congo.** — VERMOESEN. in *Bulletin agricole du Congo Belge*, Vol. V, No. 1, pp. 186-202, figs. Brussels, 1914.

These diseases are divided into four groups :

a). *Root diseases.* — They are very rare, only two or three very doubtful cases having been observed. This may be attributed to the resistance to root-diseases possessed by cacao and the fact that the first cacao plantations in the Mayumbe have been made on partially cleared forest land in which the trees were not all cut down, so that the soil is not covered with numerous trunks and dead stumps which favour the development of root parasites.

b). *Trunk disease.* — The chief external symptoms are a yellowing and sudden and simultaneous drying of all the leaves and twigs of the bush. Very often the disease spreads to the roots. On removing the bark of a diseased tree large blackish spots are seen ; these extend irregularly, but chiefly in a longitudinal direction and on the death of the tree more or less completely surround the trunk. The diseased condition of the wood extends inwards to a variable depth (up to 1 ½ inches). It does not necessarily extend completely round the trunk at a given height, but extends for the whole length of the tree in the form of irregular spots which collectively extend round the circumference of the trunk. Further examination of the surface of a stripped tree during the early stages of the attack (*i.e.* on the yellowing of the leaves) shows the presence of small galleries produced by insects and corresponding to the position of the spots. These insects attack healthy vigorous trees independently of the fungus, and they are always present on diseased cacao plants, even during the last stages of the disease.

If a diseased tree is left in a damp shady place for a few days the characteristic spores of a *Diplodia*, probably *D. cacaoicola*, appear in large quantities on the trunk and branches. Microscopical sections of the black spots show the presence of myriads of hyphae of a brown mycelium to which the black discoloration of the diseased areas is due.

It is more than probable that the above-mentioned insects become infected with the viscid *Diplodia* spores which are so abundant on the dead branches, decomposing fruits and especially refuse pods, and introduce them into their galleries in the bark of the tree, thus causing infection.

To control this disease the writer recommends in the first place that all diseased trees should be cut to the surface of the ground without delay, on the appearance of the first symptoms of the disease ; then the cut surfaces should be coated with a layer of vegetable tar. Attention should be given to the clearing up of all rubbish, such as dead or useless trees in the plantations. Where it is not practicable to burn the empty cocoa pods they should be buried with lime.

c). *Diseases of the branches.* — Canker disease is caused by the punctures of *Sahlbergella singularis* (Hemiptera). "Red rust" is due to an alga, *Cephaleuros virescens*, which causes the premature fall of most of the leaves, and is especially prevalent in situations exposed to the sun. There are also other less serious diseases of the branches and leaves.

d). *Diseases of the fruits*. — There are several different kinds of rots caused by *Phytophthora Faberi*, *Diplodia cacaoicola*, or an undetermined *Colletotrichum*: the latter fungus develops more rapidly on fruits attacked by *Sahlbergella singularis*.

1073 — **Damage caused by *Marssonia Rosae*, in the Roseries near Lyons.** — CHIFFLOT, in *Comptes Rendus hebdomadaires des Séances de l'Académie des Sciences*, 1914, 2nd Half-year, Vol. 159, No. 4, pp. 336-338. Paris, 1914.

As a result of observations of rose gardens in the Lyons district, valuable contributions to our knowledge of *Marssonia Rosae* (Bon.) Br. et Cav. (Melanconiaceae) have been obtained, and it has been realised that this fungus is a more serious pest than was formerly believed.

Not only is the leaf-blade liable to attack as early as June, but also the petiole, stipules and stem are liable to be attacked by the fungus. Further, the disease appears towards the end of September on the flowers, beginning at the base of the sepals, petals and stamens. Although formerly regarded as a leaf-parasite, this fungus may attack all the aerial organs of the plant, especially in certain less resistant varieties. Further, the mycelium, though generally considered as subcuticular, may penetrate into the parenchyma of the leaves and the woody tissues of the stem. It appears that the mycelium is persistent and that it is possible that budding from infected trees will spread the disease.

Although the fungus is difficult to destroy, it is not impossible to prevent the attack. Infected leaves should be removed and burnt with all fallen leaves. After pruning, the soil and the branches should be sprayed with either Burgundy or Bordeaux mixture or copper acetate, the latter in the proportion of $\frac{3}{4}$ lb. to 1 lb. in 10 gallons of water. The addition of 1 oz. of gelatin previously dissolved in 1 quart of warm water improves the adhesive power of the solution. This treatment has given excellent results near Lyons; the prevention of defoliation thus obtained is favourable to the ripening of the wood and the formation of fruits.

1074 — **Field Studies on the *Endothia* Canker of Chestnut in New York State.** — RANKIN, W. H., in *Phytopathology*, Vol. 4, No. 4, pp. 233-260, figs. 1-2, plate IX. Baltimore, Md., 1914.

These experiments were conducted in temporary field laboratories located at Highland, New York and Napanoch during 1911-13.

In 1911 the disease was abundantly widespread east of the Hudson river as far north as Albany and made the greatest ravages along the state line between New York and Connecticut. West of the Hudson River the disease had not advanced as far north. In Albany County the disease was only general in the southern part. A few spot infections were found in southern Delaware County along the Delaware and Susquehanna Rivers. One spot infection was found at Masonville, Delaware County, and was destroyed. No infections were known west of this region in 1911.

In 1913 the strip along the Delaware River was found to be abundantly affected where previously only isolated spots were found. The disease does not appear to be spreading as rapidly north as west and no infections were found in Otsego County.

In the inoculation of lenticels, glass rings were fixed to the branches with grafting wax so as to maintain a proper humidity for spore germination on the bark. The enclosed bark was then sprayed with a suspension of ascospores in water and the ring sealed with a coverglass. Eleven such inoculations were made and in no case was infection accomplished, whilst every case of wound inoculation produced cankers.

Attempts to obtain inoculation through natural cracks in the bark were also unsuccessful. It is therefore reasonable to conclude that the fungus is not able to penetrate healthy tissue as single hyphae, but when sufficient dead tissue is present to afford the fungus a chance to form the mycelial fans it invades the living tissues.

Mycelium from pure cultures, bits of affected bark, conidial spore-horns, pycnidia from wood, and conidia and ascospores suspended in water, were all capable of producing infection when introduced into open wounds in the bark.

The fact that infection cannot be obtained in old wounds such as insect tunnels is unexplained as yet. Possibly partial callus development and suberisation of the exposed tissue accounts for it.

As a general rule the primary infection of healthy trees takes place in the smaller branches and usually in limbs towards the top or outside of the crown where they are more or less exposed.

Numerous inoculation experiments have shown that two and three year old branches remain susceptible to the disease throughout their growing period, whilst first year shoots are immune during the spring and are only exposed to infection during the summer.

No infection is possible through the midribs of the leaves. No difference in susceptibility between young and old bark was noticeable, except in the case of the present year's growth during the spring, nor was any seasonal variation observed in the degree of susceptibility. Cessation of the growth of the mycelium in the bark during winter, as well as negative results of inoculation at this time of the year, is explained purely on the basis that the temperature is too low for the vegetative activity of the fungus. The healthiest and most vigorous trees are as susceptible as the slow growing, half-dead or otherwise injured trees. Drought and cold do not appear to affect the tree's resistance to the disease and there does not appear to be any relation between the water content of the bark and the rate of growth of the mycelium. Such variations as occur may be explained by other environmental factors, mainly temperature.

Of morphological interest is the development of a form of pycnidium without stroma which is often found on the wood beneath the loosened bark and on the cut ends of stumps and logs.

Other morphological characters of the fungus and the ejection of spores are also dealt with.

- 1075 - Two New Wood-destroying Fungi: *Fomes putearius* and *Trametes setosus*. — WEIR, JAMES R., in *Journal of Agricultural Research*, Vol. II, No. 2, pp. 163-167, plates IX-X. Washington, D. C., 1914.

The writers gives the systematic description of two new Polyporaceae, *Fomes putearius* and *Trametes setosus*. The former is closely related to *Fomes conchatus* (Pers.), which is always found on the wood of deciduous trees, especially oaks and willows (*Salix* spp.), and which has not yet been reported on wood of conifers nor been collected in the West. Several collections at hand from southern Germany are all on the wood of broad-leaved trees. *Fomes putearius*, on the other hand, always occurs on coniferous wood: *Pinus ponderosa*, *Pseudotsuga taxifolia*, *Picea Engelmanni*, with a preference for larch (*Larix* spp.). The rot produced is one of the most conspicuous found in the northwestern forests and is similar to that produced by *Trametes pini* Fries., but the reduction of lignin is on a much greater scale. The fungus was first collected in the Kaniksu National Forest, near Priest River, Idaho. It is distributed throughout the Northwest and is most abundant in the white pine zone.

Trametes setosus is chiefly parasitic on *Pinus monticola* and occurs occasionally on the wood of other trees, but always on conifers. *Polyporus gilvus* Fr., which seems to be the nearest relative and is usually found on the wood of deciduous trees, has not been collected in the West. *T. setosus*, on account of its abundance, causes serious damage to fallen merchantable timber in forest-fire areas. The chemical action of the mycelium on the wood is to reduce the lignin principally in the spring wood, leaving a cellulose ring alternating with sound autumn wood, which causes the annual rings to separate. It was also first obtained in the above-mentioned forest of Idaho and it is distributed throughout the white pine (*Pinus monticola*) belt of the Northwest; specimens have been collected in all the principal forest areas from Vancouver, B. C., to Montana.

INSECT PESTS.

GENERALITIES

- 1076 - The Life Cycle of *Sitona lineata* in Germany. — MOLZ, E., and SCHRÖDER, D., in *Zeitschrift für wissenschaftliche Insektenbiologie*, Vol. X, Part 8-9, pp. 273-275. Berlin-Schöneberg, 1914.

The pea-weevil (*Sitona lineata* L.), which is recorded as particularly injurious in England, should also be classed among the dangerous insects in Germany.

During 1913 the Experimental Station for plant diseases at Halle received notification of 14 occurrences of the insect causing damage by devouring the edges of leaves of leguminous crops; seven outbreaks were on peas, two on beans, two on lucerne, and one each on haricot beans, vetches and clover. One case was also recorded on chicory.

The writers have observed the larvae towards the end of April and the adults towards the end of May. In the open, according to information received, the adults appear in April and May as well as in July and August.

It appears therefore that the beetle is double-brooded in Germany as in England.

In order to reduce the damage in the larval stage which occurs on chicory and beets in April, it is advisable to sow later in districts liable to attacks. Since the larvæ begin to pupate at the end of April and beginning of May the larval stage will be almost completed before the plants appear. It is also desirable to make a thicker seeding in the infested areas.

1077 - The Preparation of Lime-Sulphur Solution. — *The Agricultural Gazette of Tasmania*, Vol. XXII, No. 7, pp. 255-257. Hobart, 1914.

The Sub-Committee on Fruit-Culture of the Department of Agriculture of Tasmania, after careful examination, recommends the following formula for concentrated lime-sulphur solution (in parts by weight): 50 pure lime, 100 pure sulphur, 500 water. (1) They also recommend dilutions of 1 in 7 (about 14 per cent.) for winter spraying of fruit-trees, 1 in 28 (about 3½ per cent.) for summer spraying of deciduous trees, and 1 in 20 (5 per cent.) for citrus trees (2).

1078 - The Practical Efficiency of Food Traps in the Control of Vine Moths (*Conchylis ambiguella* and *Polychrosis botrana*), and the Presence of the Vine Pyralid (*Oenophthira pilleriana*) in Piedmont. (3) — TORI, M., in *Rendiconti delle sedute della Reale Accademia dei Lincei, Classe di scienze fisiche, matematiche e naturali*, 1914, 2nd Half-year, Vol. XXIII, Part I, pp. 15-18. Rome, 1914.

MEANS
OF PREVENTION
AND
CONTROL

Attempts to catch the moths of *Conchylis* and *Polychrosis* in the spring time by means of vessels containing a fermenting sugary liquid made at Alice Bel Colle (prov. Alessandria), had met with little success. The writer therefore repeated his experiments in the summer from July 9 to August 5, placing earthenware vessels containing fermenting liquids at each of the four corners of a vineyard of about an acre in area surrounded by other vineyards; water was added every few days to the pots to make up the loss from evaporation.

At the end of this period 10 *Conchylis*, 73 *Polychrosis* and many other insects, including 2 *Oenophthira*, were caught in the liquid. This method does not appear to be favourable to trapping the last-named moth, which would probably be more attracted by lamp-traps.

From July 18 to August 11 F. Monticelli experimented with two vessels, one containing strong vinegar diluted with water and the other sweet wine equally diluted; he placed them beside a large vine growing on the espalier system against a wall in the town. All the moths captured belonged to *Polychrosis*; 7 were caught in the vinegar and 20 in the sweet wine. A large number of Hymenoptera were drowned in the liquids, most being in the vinegar.

(1) This is the same as the formula recommended by the Citrus-growing Station of Acireale (Sicily): see No. 753, *B.* April 1912. (Ed.).

(2) Cf. No. 753, *B.* April 1912; No. 1245, *B.* Aug. 1912; and No. 317, *B.* April 1913.

(3) See also No. 969, *B.* Oct. 1914. (Ed.).

This and recent experiments made in France show that liquids with alcoholic fermentation are the most suitable for the capture of the moths. Considering the small number of insects captured in a district with a large area under vines and the large number of food traps and the expense required to carry out the method effectively, as well as the fact that good results can only be obtained by cooperation of all the growers, the writer does not recommend this as a practical means of control. It is, however, valuable as an indicator of the most suitable time to commence operations with insecticides against the larvae.

In studying the development of the broods, thin active larvae of *Polychrosis* 8 to 9 mm. long and stumpy lazy larvae of *Conchylis* of the same length were found during the beginning of June. The vine was in full flower in the middle of June. As is well known the summer pupation takes place in the most diverse places; the pupae are however, rarely found in the places preferred as a winter refuge, but more frequently in the bunches and in leaves spun up by *Oenophthira*. At the beginning of July, the first adults of the second brood are on the wing; all the adults collected, belonging chiefly to *Polychrosis*, were males; it is therefore certain that in this species the males appear before the females.

Large numbers of larvae of *Oenophthira* were noticed in certain places near Alice Bel Colle, though the damage up to the present has not been very important. This is attributed to the abundance of parasites, especially Tachinids, but it is possible that the moth may become very injurious in certain years.

INSECTS
INJURIOUS
TO VARIOUS
CROPS

1079 - *Euxesta chavannei* and its Relation to the Sugar Cane Disease caused by *Bacillus Sacchari*, in the Province of Tucuman, Argentine. — BRÈTHES, JEAN, in *Bulletin de la Société entomologique de France*, 1914, No. 2, pp. 87-88, 1 fig. Paris, 1914.

This article contains a description of the new species *Euxesta chavannei* (Diptera), which, according to the collector M. JEAN CHAVANNE, causes the decomposition of the young shoots of the sugar cane and prepares the way for the entrance of the disease known as "polvillo" caused by *Bacillus Sacchari* Speg.

This species is allied to *E. acuta* Hend. and *E. argentina* Brèthes.

1080 - *Sahlbergella singularis* and other Pests on Cacao in the Mayumbe, Belgian Congo. (1) — MAYNÉ, R., and VERMOESEN in *Bulletin Agricole du Congo Belge*, Vol. V, No. 2, pp. 261-281, figs. 110-116. Brussels, 1914.

Sahlbergella singularis Hagl. is the most active and most dangerous pest in cacao plantations in the Mayumbe. It appears in abundance twice a year, viz. at the beginning of the rainy season (October-November) and towards the end of this period (April-May). There are also other less numerous broods throughout the rainy season.

This insect is most active at night and the effects of its punctures vary according to the organ attacked. In the case of fruits a small vitreous-look-

(1) See also No. 1072, B. Nov. 1914.

(Ed.).

ing dark green spot appears immediately after the insect has made the puncture; this spot then becomes surrounded by an opaque border of a brownish red colour, which gradually spreads over the spot; the surface then becomes depressed, and as the spot develops the edges take on a pale orange colour, while the centre turns black.

The damaged tissues grow more slowly than the surrounding healthy tissue, producing cracks, which are soon invaded by fungi or insects, which may produce complete rotting of the fruit or cankers.

On the green branches the spots are at first like those on the fruits; in general they are elongated and much depressed; frequently the tip of the shoot dies.

On the lignified branches the punctures develop into longitudinal fissures, which become more numerous as the branch grows and expose the woody vessels. These wounds may soon heal of themselves, or they may extend round the branch owing to successive attacks of the insect or to the intervention of other insects or fungi.

If the attack is serious, the trees gradually lose their leaves and also the greater part of their lateral branches. Sometimes even the larger branches dry up completely.

Other Hemiptera causing similar cankers are: *Helopeltis* sp. (on the fruits and rarely on the twigs); *Atelocera serrata* Westw. (common on the twigs) and two undetermined species (rarely on the fruits).

The fungi which cause the rotting of wounded fruits are: *Phytophthora Faberi* Maubl. (at present rare), *Colletotrichum incarnatum* Zimm. and *Diplodia cacaoicola*; on decomposing fruits two species of *Nectria* have also been observed, one allied to *N. Bainii* Massee, with *Fusarium* sp., etc. The following have been found on the branches: *Diplodia*, *Colletotrichum* sp., various undetermined Ascomycetes, and besides *Fusarium* sp. other Hyphomycetes, one of which probably belongs to the genus *Tubercularia*.

A combined wash of Bordeaux mixture and petroleum emulsion is recommended for the control of *Sahlbergella* and the other insects and fungi. The wounds should be dressed with vegetable tar, since coal-tar causes a prolonged sterility of the branches. Burning of twigs, branches and dead bushes lying in the plantations is also recommended.

1081 - Insects injurious to Tobacco in Hawaii. — FULLAWAY, D. T., in *Hawaii Agricultural Experiment Station, Bulletin* No. 34, pp. 20 + 9 figs. Washington, 1914.

An account of the principal insect pests of tobacco in Hawaii with reference to their distribution, biology, habits, means of control, natural and artificial, etc.

I. Insects attacking the plant.

a) *Caradrina reclusa* is the most common of the "cutworms" in these islands and is known locally as "peelua". This moth was probably introduced a short time ago from Fiji and is now one of the most injurious pests. It is often necessary to replant the crop six or seven times, in spite of the general distribution of poisoned baits and hand picking. Much of the difficulty of the control of the insect is due to the rocky nature of the soil, making it difficult to work. After thorough cultivation of

the soil, the best artificial means of control consists in the spread of poisoned baits amongst the plants (white arsenic or Paris green mixed with moistened and sweetened bran, flour, or middlings). The edges of fields adjacent to uncultivated land are often trenched, so as to present a steep surface on the exposed side which the cutworm cannot climb. Handpicking is sometimes resorted to, but is altogether too slow and expensive. Amongst their natural parasites are: *Frontina archippivora*, *Chaetogaedia monticola*, *Ichneumon koebelei*, *Trichogramma pretiosa* (1) and several birds, which should be protected and increased in number by importation.

b) *Phthorimaea operculella* (2), or common Gelechiid moth, was first noticed in Hawaii in 1892. The grub (tobacco splitworm) mines the leaves of its host plants, making a broad, flat track through the mesophyll between the upper and lower epidermis, which often becomes badly split and shattered when dry.

It is most injurious to seed-bed plants and considerably retards their growth, so that sturdy seedlings for transplanting are difficult to obtain. This trouble is partly overcome by seeding the beds very thinly and protecting them with cotton netting. The damage on well-conducted plantations is generally confined to the two or three poor soiled lower leaves. In neglected plantations however the disease becomes general.

The grubs can be destroyed by dusting arsenate of lead on the plants in the seed-bed when they are emerging through the epidermis to form new burrows. The arsenic may also be applied as a spray combined with Bordeaux mixture. Under field conditions this treatment is of little value and very expensive. As a precaution against general infestation no solanaceous plants should be grown near the tobacco fields and all solanaceous weeds in the immediate vicinity should be periodically destroyed. The most common parasites of this pest are *Chelonus blackburni* and *Limnerium blackburni*.

c) *Heliothis obsoleta* (3), the tobacco pod-borer, or cotton boll-worm, injures the tobacco plant chiefly by boring the seed pods and to some extent devouring the foliage. In Hawaii it is never found on either corn or cotton and is not generally considered a serious pest of tobacco. It is held in check by topping the plants as soon as the flowers appear, and when seed is desired the flower stalks are enclosed in a bag. Neglected fields always show signs of the borer and if for any reason a field of standing tobacco is abandoned, the plants should be ploughed up and destroyed to avoid a general infestation. The eggs of this moth are probably parasitised by *Trichogramma pretiosa*, though it is not recorded as being actually bred from *Heliothis* eggs in Hawaii. It is possible that it is also attacked by the common tachinid parasites.

d) *Phlegethontius quinquemaculata* (4), or hornworm, is extremely

(1) See also No. 438, B. April 1913.

(2) See also No. 1117, B. July 1912.

(3) See also No. 2584, B. Aug.-Sept.-Oct. 1911; No. 627, B. June 1913 and No. 1117, B. Sept. 1913. (Ed.).

(4) See also No. 1118, B. Sept. 1913. (Ed.).

uncommon and has never been seen by the writer on cultivated tobacco. It is sometimes found near Honolulu on the wild tobacco (*Nicotiana glauca*), which it soon defoliates.

If it were to appear in tobacco fields it could be checked by spraying with lead arsenate (3 lbs. to 100 gallons of water), to which the young larvae are very susceptible. Large worms should be hand picked, as it is difficult to kill them with a stomach poison. Its natural enemies are not known, but there is probably an egg parasite.

e) *Epitrix parvula*, or tobacco flea-beetle, is of recent introduction into Hawaii. Both larvae and adults cause damage, especially the latter, by piercing holes and breaking up the margins of the leaves. It is more common and injurious in neglected plantations, especially in the neighbourhood of other solanaceous plants.

In growing tobacco commercially it is necessary to exercise care and allow no plants to remain after the tobacco has been picked. Other solanaceous crops and weeds in the neighbourhood should be periodically destroyed. When the insect causes damage the affected plants may be sprayed with arsenate of lead, 1 lb. to 20 gallons of water, or half this strength if the arsenate is in paste form.

f) *Minor pests*: the larvae of *Plusia chalcites* and *Amorbia emigratella*; *Pseudococcus citri* and *P. virgatus*; *Siphanta acuta* and *Pulvinaria psidii*; *Elimaea appendiculata* and *Xiphidium varipenne*; *Nysius delectus* and *Xyleborus* sp.

II. Insects affecting the stored product.

Lasioderma serricorne, or cigarette beetle, is very injurious and was first observed in Hawaii in 1885. It is generally destroyed by fumigation with carbon disulphide or hydrocyanic-acid gas. This method gives admirable success where the infestation is only incidental and local and the infested material can be placed in a tight compartment so that the full strength of the gases can be utilised. When the infestation becomes general, as in warehouses in which stored products are being continually handled, it is exceedingly difficult to control the beetle. The only means is a systematic fumigation of the whole warehouse from time to time, or different parts of it which can be rendered tight against the diffusion of the gas. It is sometimes a distinct advantage to spray the walls and floors with benzine or kerosene. Manufactured goods are often kept in cold storage to prevent beetle injury, and if not removed too soon the danger of injury after withdrawal is greatly reduced. It has, however, been shown that even low temperatures continued for long periods are not sufficient to destroy the vitality of the eggs. A species of *Pteromalus* has been obtained as a natural parasite of this beetle.

1082 - **Peach Tip Moth injurious to Peaches and other Fruit Trees in New South Wales.** — FROGGATT, WALTER W., in *The Agricultural Gazette of New South Wales*, Vol. XXV, Part 5, pp. 413-414, 3 plates. Sydney, 1914.

Four or five years ago it was noticed in the suburban gardens and in many orchards between Sydney and the mountainous region, that the ends of young branches of peaches and nectarines were attacked by certain small

larvae which pierced one side of the shoots and bored a cavity inside towards the base, causing the drying up of the leaves and the exudation of gum at the tip of the damaged shoot. Sometimes all the branches of the tree were damaged in this manner and an otherwise healthy tree would show tufts of dead leaves at the ends of its branches.

Later developments showed large quantities of the fruits with numerous pustules covered with a gummy secretion under which insects had destroyed the epidermis.

Examination of a few specimens showed the damage to be due to a larva of a small *Tortrix*, which has not yet been identified, but which resembles the codlin moth (*Carpocapsa pomonella*) in its larval and adult forms. The damage to the surface of the fruit is more serious than that to the branches, since large scars are formed on the unripe fruits, which then become unfit for sale.

After describing the life-history, the writer mentions that the larvae cause considerable damage in the neighbourhood of Sydney, not only to peaches, but also to other fruits such as apples and quinces.

As a protection, the peaches should be thoroughly sprayed with arsenate of lead at the beginning of summer and after the appearance of the first damage. In gardens and small orchards straw-banding the trees is recommended.

1083 - The "Leaf Case Moth" (*Hyalarcta hübnéri*) injurious to Fruit Trees in Victoria. — FRENCH, C. (JUNR.), in *The Journal of the Department of Agriculture of Victoria, Australia*, Vol. XII, Part 5, pp. 294-297. Melbourne, 1914.

The "Leaf-Case Moth" has recently been recorded as doing considerable damage to apples, quinces, vines, etc.

The larva has the habit of detaching portions from different fruits, thus rendering a large quantity unserviceable. It also eats the epidermis of the leaves, giving the tree a scorched appearance. The grubs appear to have a distinct preference for the young buds, and since as many as 50 may be present on one tree the damage is considerable. Native trees such as the "tea tree" (*Leptospermum*), eucalyptus and even imported plants (pines and cypress) are attacked with avidity by the pest, though it appears to prefer fruit trees.

The larvae adorn their exterior protective sheath with portions of the leaves upon which they are feeding. If a half-grown larva is transferred to another tree it changes its old covering of leaves for the new leaves.

Another closely allied species, *H. nigrescens* Doubl. (ribbed case or bag moth) causes damage to eucalyptus, but it has not yet been found on fruit trees.

H. hübnéri is easily destroyed by means of spraying with arsenate of lead.

1084 - Insect Pests of Citrus in Ceylon. — RUTHERFORD, A., in *The Tropical Agriculturist*, Vol. XLIII, No. 1, pp. 49-50. Colombo, July 1914.

The leaf-miner (*Phyllocnistis citrella*) is described in detail. The caterpillar of this Tineid moth mines underneath the upper or the lower epi-

dermis of the young leaves, thus causing them to curl up. The mines also occur underneath the epidermis of the young twigs. The mine often begins near the midrib, runs towards the base of the leaf, where it takes one or two turns, runs alongside the margin and takes one or two turns and then approaches close to where it began. The course of the mine is marked out by a narrow band of brownish frass and the mine itself has a silvery appearance. Not infrequently 4 or 5 caterpillars may be present in a single leaf.

The caterpillars are subject to the attack of small, black Chalcids, which, however, are unable to keep them in check. Were the attack noticed early enough a spraying with tobacco extract might do some good. But it is usually finished before the casual observer's attention is drawn to it. The citrus grower should make himself acquainted with the first symptoms and be on the look out for them.

Sometimes the folded leaves are subsequently tenanted by mealy bugs (*Pseudococcus* sp.), which continue the injury; but these are less injurious in Ceylon than in many other countries. Here, they are attacked by various enemies, the two chief being the caterpillar of the Lycoenid, *Spalgis epius* West., and a Cecidomyiid (*Diadiplosis coccidivora* Felt.).

A moth very similar to that of the leaf-miner was reared by the writer from leaves of *Melia Azedarach*, but the pupa showed several points of difference.

Other insects that have been observed or recorded recently as doing more or less damage to citrus trees in Ceylon are:

1) *Walkeriana* sp. This large coccid encrusts the stem and branches and is heavily parasitised by an Agromyzid, *Cryptochaetum curtipeinne* Knab. The scale is attended by a species of *Cremastogaster*, but the ants do not succeed in deterring the *Cryptochaetum*. 2) *Coccus viridis* Green, or "green bug". 3) *Lepidosaphes beckii* Newm. infests the fruits and leaves, causing the latter to crumple. 4) *Toxoptera* sp., an aphid found occasionally on young shoots, but not sufficiently numerous to cause damage. 5) *Tetranychus mytilaspidis* Riley; a mite closely resembling this occurs on the leaves, causing them to become yellow. 6) *Apo-gonia comosa* Kav., Melolonthid beetle reported as eating the leaves.

Occasionally, from fruit that has fallen prematurely, small bright-eyed flies emerge. These are Drosophilids, whose habit is to lay their eggs in fermenting material. The fruit falls from some other cause and the flies probably infest it as it lies on the ground.

1985 - *Otiorrhynchus sulcatus* attacking Vines in the Ile d'Oléron, France. — RIGOTARD, MARCEL, in *Journal d'Agriculture pratique*, 1914, Vol. II, No. 29, p. 94. Paris, 1914.

The vines in the Ile d'Oléron have been attacked by *Otiorrhynchus sulcatus* F., which appeared for the first time in 1913. The centre of infection is in the communes of Saint-Pierre, Saint-Georges, Dolus and Le Château.

The adult weevil devours the buds and shoots of the vines and the larva feeds on the roots of this and other plants (strawberry, raspberry,

peach, etc.). The damaged roots may succumb to their injuries, and the shoots whose tips are repeatedly damaged are short and knotty and cannot be pruned properly.

Of the various methods of control, the simplest and most efficacious consists in collecting the adults in traps consisting of tufts of grass, moss or dried leaves, exposed at the base of the vines and inspected daily. A local syndicate collected as many as 90 lbs. of insects in two weeks by this method, and it requires about 7 000 insects to weigh 1 lb.

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The Bureau assumes no responsibility with regard to the opinions and the results of experiments outlined in the Bulletin.

The Editor's notes are marked (Ed.).

FIRST PART.
ORIGINAL ARTICLES

The Forests of Chile.

by

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Of the 185 939 400 acres which constitute the whole area of Chile, 38 907 750 acres are covered with forest. The distribution of the forests is very irregular and is made clearer by dividing them into the following six forest regions :

Region I. — From the northern frontier of the Republic as far as Taltal, including the provinces Tacna, Tarapaca and Antofagasta, of which only from 0.01 to 0.03 per cent of the area (in all 52 000 acres) is wooded. The forests are composed of *Prosopis Tamarugo*, *Cordia decandra* and other less important species.

Region II. — From Taltal to the river Choapa ; this includes the provinces Atacama and Coquimbo, of which only from 0.3 to 2.5 per cent (in all 226 600 acres) consists of forests. The trees here are *Gourliea decorticans*, *Caesalpinia brevifolia*, *Porlieria hygrometrica*, etc.

Region III. — From the river Choapa and to the south as far as the Maule. This district includes the provinces Aconcagua, Valparaiso, Santiago, O'Higgins, Colchagua, Curico and Taltal, with a total of 1 732 000 acres of forest ; in the first four the forest area does not exceed 5 to 8.5 per cent, while in the last three it may amount to 12 or even 17 per cent. The forests of the first group of provinces contain only *Acacia Cavenia*, *Bellota Miersii*, *Quillaja saponaria*, *Maytenus Boaria*, *Litrea caustica*, *Boldoa fragrans*, *Cryptocarpa Peumus*, *Drimys Winteri*, *Prosopis Siliquastrum* and other secondary species, while in those of the three last we already encounter *Nothofagus macrocarpa*, *N. obliqua* and *N. Dombeyi*, *Gevuina Avellana*, *Kageneckia oblonga* and *Libocedrus chilensis*, with other less important species.

Region IV. — From the river Maule to the river Valdivia, including the provinces Linares, Maule, Ñuble, Concepcion, Arauco, Bio-Bio, Malleco, Cautin and a large portion of Valdivia, with a total of 5 700 000 acres of forest; the percentage reaches from 17.5 to 35.5. The abundance of forests increases in the following order: Valdivia, Bio-Bio, Malleco, Ñuble. As far as the river Bio-Bio, the exploitable timber is furnished by the following species: *Acacia Cavenia*, *Quillaja saponaria*, *Maytenus Boaria*, *Litrea caustica*, *Boldoa fragrans*, *Cryptocarpa Peumus*, *Drimys Winteri*, *Nothofagus obliqua*, *N. Dombeyi*, *Gevuina Avellana*, *Persea Lingue*; in the south of Bio-Bio, *Acacia Cavenia* and *Quillaja saponaria* are absent, while in addition are found: *Lomatia dentata*, *Myrceugenia apiculata*, *Podocarpus andina*, *Prumnopitys elegans*, *Araucaria imbricata*, *Nothofagus procera*, *Laurelia aromatica*, *Myrceugenia Luma*, *Nothofagus Pumilio*, *Libocedrus tetragona*, *Myrceugenia Temu*, *Myrceugenia multiflora*, and other less important species.

Region V. — This extends from the river Valdivia to the peninsula Taitao, including the provinces Valdivia (southern part), Chiloé and Llanquihue, with a total of 11 145 000 acres of forest (40 per cent of the whole area of the region). This region is already outside the range of *Araucaria imbricata*, *Nothofagus procera* and *Laurelia aromatica*, while *Nothofagus obliqua*, *Maytenus Boaria*, *Libocedrus chilensis*, *Nothofagus Dombeyi*, *Persea Lingue* and *Podocarpus andina* are not found beyond the Chacao canal; on the other hand the following begin: *Embothrium coccineum*, *Calcluvia paniculata*, *Weinmannia trichosperma*, *Sophora tetraptera*, *Myrceugenia Meli*, *M. planipes*, *Tepualia stipularis*, *Maytenus magellanica*, *Nothofagus nitida*, *N. betuloides*, *Libocedrus tetragona*, *Fitzroya patagonica*, *Laurelia serrata*, *Eucryphia cordifolia*, *Podocarpus chilina*, *Lomatia ferruginea* and other species in small numbers,

Region VI. — This comprises all the territory of Magellan as far as Tierra del Fuego, and has some 20 million acres of forest, or about 30 per cent of its area. These forests consist of the trees mentioned as occurring south of the Chacao canal, with the exception of *Nothofagus nitida* and *Lomatia dentata*, but gradually the number of all the trees decreases till there remain only *Nothofagus betuloides* and *Maytenus magellanica* and some species of *Myrceugenia* as stunted shrubs.

From the area of 38 million acres classed as forest, must be deducted: 8 908 200 acres used as pasture, 18 576 950 acres which produce firewood only, and 6 092 180 acres which only supply stakes and small wood; there therefore remain only 5 002 110 acres which can be exploited for large timber.

A very important fact which merits consideration also is that of these 38 million acres covered with forest, 20 million acres are upon agricultural land, about 7 ½ million acres are under forest that is beginning to grow, or are pasture, or of uncertain classification and only 11 400 000 acres are on true forest land. On the other hand, nearly 10 million acres of true forest land which were formerly wooded are now completely cleared, the greater part being eroded and worn into gullies by rain, so that it will

soon come under the category of waste land. The immoderate deforestation practised for the purpose of obtaining fuel, and the irrational system of cultivating steep slopes liable to slip under the influence of heavy rains, explain the present existence of 153 000 acres of dunes and the want of water for irrigation, drinking purposes, etc., which prevails in the spring and autumn.

The exploitation of the existing forests requires means of transport, viz. alteration of river courses, construction of roads and a thorough system of railways. Only concerns with abundance of capital (which latter is lacking in our country) could undertake such operations, all the more as the State does not possess the necessary funds to carry out the work at its own expense. Wealthy foreign capitalists are therefore required in Chile, where they will find an extensive and lucrative field for the development of their trade.

Generally wood in Chile is sold green as soon as it has been felled ; it is badly worked, or hastily piled up, so that it arrives on the market warped, cracked and out of shape.

There are only a few firms which have drying apparatus and it is necessary to encourage and increase such plant, in order that the wood may be exported in the best condition possible. The consumption of the country is not sufficient to absorb the enormous amount which should be produced by the forests in the next few years. The export of wood should be based upon transport by sailing ships, which is more economical than transport by steamers, all the more, seeing that at present there are no means of lowering steam freights, which are very high, amounting to from 30 to 35 shillings per cubic metre (35 cu. ft.) from Chile to Europe.

The two first forest regions were exclusively engaged in importing, but they are now beginning to export pods of *Prosopis Siliquastrum*, which contain from 35 to 50 per cent. of tannin ; they give a tawny yellow colour to leather and render it supple. *Cordia decandra*, already rather a rare tree, yields a yellowish brown wood with pretty black markings and is used for ornamental veneering. The wood of *Porlieria hygrometrica* can be used for engraving.

The third forest region also has to import wood ; it furnishes the bark of *Quillaja saponaria*, which contains from 15 to 25 per cent of saponin and is largely exported. For furniture making are used the wood of *Bellota Miersii*, *Maytenus Boaria* and *Drymis Winteri*, while the wood of *Prosopis Siliquastrum* is used by the cabinet-maker and enlayer ; it resembles that of *Cordia decandra*, but is already very rare. *Acacia Cavenia* might be used for ornamental purposes, but is generally burnt for charcoal or used as firewood or by the wheelwright ; the same applies to the wood of *Litrea caustica* and *Prosopis Siliquastrum*. The leaves of *Boldoa fragrans*, and its extract, the well-known *boldoina*, a remedy for diseases of the liver, the urinal and digestive systems and also for internal parasites, should be important articles of export. The present stock of *Nothofagus obliqua*, *N. macrocarpa* and *Libocedrus* no longer suffices for the most pressing needs of the district.

The fourth forest region, in its part to the north of the river Bio-Bio, only exports *Quillaja saponaria* bark, for it does not produce sufficient wood for cabinet-making even to supply its own requirements, and is obliged to obtain it from the provinces south of this river. These, which are usually called "La Frontera", possess the richest forests of the Republic.

In the first place we may mention as growing there: *Nothofagus obliqua*, yielding a dark red wood, hard and heavy, which lasts for 25 years and more in the ground, and is more resistant than that of most pines and is much used for beams, planks, wharves and piles.

Nothofagus Dombeyi, when its heartwood is of a dark red colour, shot with pale reddish or greenish hues, is as durable as *N. obliqua* and a little harder; in the trade the two timbers are confused. The pink *Nothofagus Dombeyi* does not last long, while the white form, which covers large tracts of country, could, owing to its low price, be used advantageously in the chemical manufacture of cellulose, but its lack of durability renders it of doubtful value in the mechanical process where cylinders are used.

The wood of *Nothofagus procera*, which is dark red with a slight violet reflection, is a little less hard than that of *N. obliqua*; it is durable, easy to work and polish, does not break and is the material most used in the interiors of houses. On account of its good qualities, it is difficult to find a substitute. Doors, furniture and windows of this wood last indefinitely; it is also much used for small casks for ordinary wines and in cooperage generally. It is perhaps the best wood for the above-mentioned purposes.

The wood of *Laurelia aromatica* is of an ashy yellow colour, sometimes with dark spots or lines; it warps and is not very durable in damp, but is much used, and with good results, for the interiors of houses and for furniture.

Persea Lingue wood is reddish, pinkish, or yellowish, sometimes with pretty dark rays. It is heavy, hard, elastic and fibrous and adapted to all purposes. As it retains dyes well, this product is used in the imitation of "nogal", "caoba", etc., and is with good reason much appreciated in the country.

The wood of *Podocarpus andina* is of a lemon-yellow colour, less hard and more supple than the preceding products, and is used in the interior of houses both by the joiner and the carpenter. It is not very plentiful.

Libocedrus wood is yellowish white with pale brown rays, a little reddish in the centre; it is supple, elastic, fibrous, perfumed, does not decay and is used for all kinds of building, furniture, carpentry, beams, posts, props, etc. It is much appreciated in the country, but difficult to exploit, because it grows on slopes far from all means of transport.

Myrcengenia Luma yields a dark red, heavy, very hard, elastic wood, which does not decay and is most suitable for wheelwright's and carpenter's work, especially in the making of poles, wheel spokes, stakes, etc.

The wood of *Araucaria imbricata* is whitish, a little yellowish, supple, hard and durable; it is employed for all kinds of structures, furniture, posts, and even beams, but as the tree grows on the summits of distant

mountains it has only lately begun to be exploited. The seeds of this tree serve as an article of food for the peasantry during much of the year.

The following would be very valuable woods for furniture, veneers, flooring, etc., both in Chile and abroad: *Gevuina Avellana*, *Lomatia dentata*, *Prumnopitys elegans* and *Drimys Winteri*; but, on account of the fashion of using foreign products, these will not be appreciated at home as they should, until the appreciation of the exported timber shows that we have not rightly valued our national riches.

The barks of *Persea Lingue* and of *Drimys Winteri* are decidedly important, and might be even more so; these are richest in tannin (15 to 30 per cent) when they are thinnest, and are stripped from the trees at the end of winter or in early spring. This bark is the best adapted for tanning leather for soles.

The fifth forest region, in spite of its abundant forests, imports some timber of *Nothofagus obliqua*, *N. procera* and *Persea Lingue* from the fourth region, as well as *Weinmannia trichosperma*, *Caldcluvia paniculata*, *Sophora tetraptera*, *Myrceugenia Meli*, *Tepualia stipularis*, *Eucryphia cordifolia* and *Laurelia*. The other species are not yet well enough studied and known, and are of less industrial importance.

The wood of *Fitzroya patagonica* is light red or reddish brown; it is very elastic and soft, but firm, fibrous and almost without knots; it does not decay, is easy to cut, and does not warp or split. It is used for all kinds of work: furniture-making, carpentry, cooperage, musical instruments, packing-cases, and especially for building in the south, as well as for sheds, partitions and roofs; it is also exported abroad. This wood is much appreciated, but cannot be sufficiently exploited on account of the difficulties of transporting the giant trees from their habitat in the high mountains.

Libocedrus tetragona and *Podocarpus andina* of the south replace by the quality of their wood the similar species which are found further north.

Nothofagus nitidus and *N. betuloides* cannot in the same way replace *N. obliqua* of La Frontera, with which they have nothing in common but their popular name, for their wood rots, splits, warps and spoils. In the same way, *Laurelia serrata* cannot replace the Frontera "laurel", for, in addition to other defects, it is less durable and has a strong smell.

The wood of *Eucryphia cordifolia* is dark reddish, hard, heavy, resistant, does not decay in water, but rots when in contact with the soil. It is used in houses for carpentry, joinery, cabinet-making; also, with varying results, for the piles of quays and for props, stakes, wheelwright's work, etc. The bark of this tree gives a hard leather and contains as much tannic acid as that of *Persea Lingue*, or more.

For flooring and high-class furniture the following woods can be used: *Lomatia ferruginea*, *Embothrium*, *Sophora*, *Tepualia*; as well as others which have been mentioned above, such as *Gevuina*, *Lomatia dentata*, *Drimys*.

Good beams can be made from the wood of *Caldcluvia* and *Weinmannia*, and posts from the latter as well as from *Sophora*, *Myrceugenia Meli* and *Tepualia*; while *Prumnopitys*, *Gevuina*, *Embothrium*, *Myrceugenia*

planipes, *M. multiflora* and *Maytenus* are used in carpentry, and *Myrceugenia Meli*, *Persea* and *Sophora* for carts and wheelwright's work; the rare "curam" more or less replaces *Nothofagus procera* for these purposes. Good charcoal can be obtained from *Myrceugenia Luma*, *Caldcluvia*, *Weinmannia*, *Sophora*, *Myrceugenia Meli*, *Tepualia* and *Eucryphia*; the two latter are used by preference for building timber.

All this would be very satisfactory, were it not that the least useful species are the most plentiful and grow largest, while the most useful are the rarest and smallest, with the exception of *Myrceugenia Luma* and *M. Meli*: these are fairly plentiful and form from 6 to 9 per cent of the forest trees, while the other species only amount to 0.5 or at most 2 per cent of the whole.

The sixth forest region already imports much more timber of *Nothofagus obliqua*, *N. procera* and *Persea* than the fifth region, although it figures as possessing half the forests of the Republic: it also takes from the fifth forest region small quantities of the wood of *Libocedrus*, *Fitzroya*, *Weinmannia*, *Caldcluvia*, *Myrceugenia Meli*, *Tepualia* and other trees, though it possesses the same species; this is owing to the want of means of communication, and to the fact that the trees decrease in size and become more irregular as they approach the south and gradually disappear.

There is a large field for exploitation and trade in the native timber trees which make up about 40 per cent of the forests in Magellan, but it must be borne in mind that lack of means of transport, the steepness of the land, the many new species unknown in the wood trade, and the present and future high freights necessitate that the exploitation of these national riches should be undertaken by large firms.

The study of Chilean timbers shows that there are very few soft, supple kinds like *Fitzroya* and *Libocedrus*, but that, on the contrary, hard heavy species abound; further, there is no substitute for oak for making casks for fine wines. This accounts for the importation, in 1912, of 1 ½ million cubic feet of pine wood (chiefly Oregon pine, *Pinus taxifolia*) to the total value of £ 160 000, of which 91 per cent came from the United States, and only 9 per cent from Europe. The same thing occurs in the case of oak staves, of which 1500 tons, worth £ 8000, are imported, while the value of the exported wood is only £ 23 000. With good management and administration, the value of these exports might amount to nearly a million sterling, and be a source of considerable revenue to the country.

Attempts are being made to supply the want of soft wood in Chile by planting rows of poplars, but their wood will never adequately replace deal for general use.

Plantations of pines on a large scale have only been made by some coal-mine proprietors, as at Lota and Curanilahue, while small plantings have been made by some of the more progressive landowners. The trees planted by the State on the dunes of Chanco are a mere drop in the bucket as far as the present needs of the country are concerned and afford no adequate provision for future requirements. Nearly all the plantations consist of poplars (usually *Populus nigra*), *Pinus insignis* or *Eucalyptus*

globulus, as rapid production is preferred to quality, to the exclusion of trees yielding good wood such as: *Pinus canariensis* and *P. maritima*, *Eucalyptus diversicolor* and *E. resinifera*, *Cupressus macrocarpa* and *C. tomentosa*, *Acacia melanoxylon*, *Quercus pedunculata*, *Picea excelsa*, *Pinus ponderosa* and *P. mitis*, *Abies*, *Picea*, *Larix*, etc. It would be well worth while to organise also in Chile syndicates, and national and foreign societies well provided with capital, which could turn their attention to the preservation, good exploitation and re-planting of the forest land of the Republic, taking as a basis the best native species, and at the same time planting such exotic trees as are acclimatised and grow even better in Chile than in their original habitat.

The want of foresight as regards the preservation, exploitation and plantation of forests is such, that any firm undertaking this work on a serious basis, can be assured of the future of its industry, all the more, as no one in the country thinks of future needs, and scarcely even considers present necessities.

List of the trees mentioned above with their local names.

<i>Acacia Cavenia</i> . . .	espino comun.	<i>Myrceugenia apiculata</i>	arrayan.
<i>Araucaria imbricata</i> . .	araucaria, piñon.	„ <i>Luma</i> . .	luma.
<i>Bellota Miersii</i> . . .	belloto.	„ <i>Meli</i> . .	meli.
<i>Boldoa fragrans</i> . . .	boldo.	„ <i>multiflora</i>	pitra.
<i>Caesalpinia brevifolia</i> .	algarrobo.	„ <i>planipes</i> .	peta.
<i>Caldcluvia paniculata</i> .	tiaca.	„ <i>Temu</i> . .	temu.
<i>Cordia decandra</i> . . .	carbon.	<i>Nothofagus betuloides</i> .	roble de Magallanes.
<i>Cryptocarya Peumus</i> .	peumo.	„ <i>Dombeyi</i> . .	coihue.
<i>Drimys Winteri</i> . . .	canelo.	„ <i>macrocarpa</i>	roble de Colchagua.
<i>Embothrium coccineum</i> .	ciruelillo.	„ <i>nitida</i> . .	r. de Chiloé.
<i>Eucryphia cordifolia</i> .	ulmo, muermo.	„ <i>obliqua</i> . .	roble pellin.
<i>Fitzroya patagonica</i> . .	alerce.	„ <i>procera</i> . .	rauli.
<i>Gevuina Avellana</i> . . .	avellano.	„ <i>Pumilio</i> . .	nirre.
<i>Gourliea decorticans</i> . .	chañar.	<i>Persea Lingue</i>	lingue.
<i>Kageneckia obliqua</i> . .	bollen.	<i>Podocarpus andina</i> . .	mañiu.
<i>Laurelia aromatica</i> . .	laurela.	„ <i>chilina</i> . .	mañiu.
„ <i>serrata</i> . . .	luahuan, laurela.	<i>Porlieria hygrometrica</i> .	guayacan.
<i>Libocedrus chilensis</i> . .	cipres.	<i>Prosopis Siliquastrum</i> .	algarrobo.
„ <i>tetragona</i> . .	cipres de Guaitacas.	„ <i>Tamarugo</i> . .	tamarugo.
<i>Litrea caustica</i> . . .	litre	<i>Prumnopsitys elegans</i> .	lleugue.
<i>Lomatia dentata</i> . . .	radal.	<i>Quillaja saponaria</i> . .	quillai.
„ <i>ferruginea</i> . .	huinque.	<i>Sophora tetraptera</i> . .	pelú.
<i>Maytenus Boaria</i> . . .	maiten.	<i>Tepualia stipularis</i> . .	tepu.
„ <i>magellanica</i> . .	m. de Magallanes.	<i>Weimannia trichosperma</i>	teñiu.

The Development of the Dairy Industry in Hungary (1).

by

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Of late years the Hungarian dairy industry has altered its aims. Formerly it dealt chiefly with the various methods of utilizing the milk that was produced, whilst at present, without giving up its old principles, it seeks to increase the yield of milk itself.

According to the last census, Hungary possessed 2 800 000 cows, which yielded about 808 million gallons of milk; at a price of 5.9 *d* per gallon, this represents a value of £ 19 867 700. For this estimate we have taken as basis the average yield of each of the breeds as shown in Table I.

TABLE I. — *Average yearly yield of the various breeds.*

Breeds	Head	Average yearly yield	
		Per cow, gals.	Total, gals.
Hungarian	630 000	198	124 740 000
Red spotted:			
Simmental & Pinzgau	1 700 000	330	561 000 000
Gray Alpine	90 000	396	35 640 000
Other breeds	290 000	242	70 400 000
Buffaloes	90 000	176	15 840 000
Total	2 800 000	—	807 620 000

In 1913 the value of the exports was as follows :

	£
Milk	443 034
Butter	206 571
Cheese	88 390
Total	797 995

The milk and its products were exported to the following countries : Austria, Bosnia-Herzegovina, Germany, Switzerland, Italy, Netherlands, Rumania, Serbia, Bulgaria, Albania, Greece, Turkey in Europe and in Asia, Egypt, United Kingdom, Russia and United States.

The total exportation of milk, butter, cheese and condensed milk corresponds to 36 029 532 gallons of milk. Comparing these figures with the 807 620 000 gallons of milk produced and mentioned above, it will be seen that our exportation of milk represents 4.46 per cent of the total production.

During the closing years of the nineteenth century there were still many communes in Hungary in which milk could not be disposed of at anything like profitable prices. This fact induced the Ministry of Agriculture to favour the institution of cooperative rural dairies. These were at first rather collecting centres than real dairies, the cream being taken to the central dairies and the skimmed milk sent back to the members. Created by two joint stock companies, the central dairies are under the control of the State, which subventions them. They produce butter of the highest quality, much appreciated at home and abroad. The first central dairy was opened at Temesvár in 1899 and the next year others were founded at Dombrovár, Veszprém and Szabadka.

Three or four years after the organisation of these dairies, a certain number of the cooperative creameries, especially the larger ones, were no longer satisfied with the sale of milk but started the manufacture of butter on their own account. At first this new departure proved very remunerative, especially when, owing to the foot-and-mouth disease and the lack of fodder, the yield of milk diminished considerably, both in Hungary and in the neighbouring countries. Nevertheless the foot-and-mouth disease which raged in 1912 revealed clearly that the recent efforts of the cooperative dairies had not yielded good results.

Since 1906 it has been a constant struggle, every year in one part or another of the country, sometimes against the drought and the shortage of fodder, at other times against floods or foot-and-mouth disease. It was natural that these adverse circumstances should lead to an increase in the prices of milk and butter, which in its turn caused the butter from the Hungarian dairies, which until then had been for the most part in demand on the Austrian markets, to be gradually ousted by Danish butter, which was preferred for both its price and its quality. The cooperative dairies suffered great losses and at present a number of them have given up making butter and limit their activity to the collecting and carrying of cream. They have thus led to the creation of three new central butter dairies in three counties. The management of these butter dairies has recognized that in order to improve the quality of Hungarian butter it was necessary to adopt all the measures suggested by the progress in science and technique, and since then the cream has been pasteurized and pure culture starters have been used.

Cooperative dairies do not develop to the extent that would be desirable for the progress of the Hungarian dairy interest. This is to be attributed to the fact that in some parts of the country the small farmer is not convinced of the utility of cooperative dairies. More than once it has happened that small farmers have abandoned the cooperative dairy if in the same commune some dealer has paid a fraction of a penny more for their milk. Still, the commercial spirit of our small farmers is awakening,

and I hope that the principle of cooperation will gradually gain ground among the producers of milk.

As for the production of our cooperative dairies, the following data are available. Since 1897 cooperative dairies have been founded in greater numbers; in that year 34 cooperative dairies with 5937 shares produced 420 759 lbs. of butter; their receipts amounted to £ 22 470. At the end of 1913, 573 cooperative dairies were in full activity; they turned out 4 730 000 lbs. of butter and their total trade amounted to £ 418 150.

The new tendency is to increase the milk yield of our cows, which has been judged insufficient. The average yearly yield of the country corresponds to 308 gals. per cow. Comparing these figures with the results obtained in the States of Western Europe, it must be recognized that there is still much margin for improvement in the production of milk in Hungary. The returns of the dairy industry in the States of Western and Northern Europe are twice as great, in Holland even two and a half times as great, as in our country.

With a view to increasing the production, milk record associations have been organized. The field of their activity is in the county agricultural societies, where they act as sections for cattle breeding or milk recording.

At present milk recording is carried out in 17 societies, in 36 districts, in which 17 000 cows belonging to 635 owners are submitted to methodical control. In one district to which the neighbouring herds are admitted, one inspector records the performance of about 500 cows. The inspectors follow a three months course of instruction in milk control, which is held in one of the dairy schools and to which only pupils who have attended a dairy school of the country and who are acquainted with the practice of dairying are admitted. In each county agricultural society, the section of milk records registers the controlled animals in a local herdbook, and the cows whose yield attains at least 660 gals. during one lactation are also admitted to entry in the national herdbook. In order to defray part of the expenses entailed by the milk control, as well as the salary of the inspector, etc., the societies or control sections receive in the course of three years, a subvention of 2000 crowns (£ 83 6s 8d) per annum from the Government. The work of the record societies is under the supervision of the Ministry of Agriculture, whose dairy section revises the results sent in by the milk inspectors. The milk record societies held last year their first national conference, at which a proposal was made to found a central milk recording station as soon as milk recording has been instituted in fifty districts. The duty of this station will be to control the work of the sections.

The record associations are very important in Hungary from the point of view of the increase of the production of milk. The experience gained in the country and abroad shows that the average yield of each cow subjected to record increases by 44 gals. during the very first year. Thus, if only 5 per cent of the stock of cows, or 140 000 head, be submitted to systematic control, the surplus of milk will be about 6 173 000 gals., worth £ 151 667. Besides the increase of milk yield systematic and economic

feeding and the keeping of pedigree books, the artificial feeding of calves is also aimed at (1).

Owing to the constantly increasing importation of cheese, efforts have also been made to start cheese factories. Nevertheless as the lack of fodder and the foot-and-mouth disease often hinder the increase of the production of milk, cheese dairying has not yet made much progress. Besides, this branch of the milk industry requires much more experience and technical knowledge and is more risky, than butter making, in which progress is clearly noticeable. The recent increase in the consumption of butter is due to the high prices of lard.

The kinds of cheese made in Hungary are especially Hungarian Emmental, Trappist, Romadour and Magyaróvár, the latter resembling the Tilsit cheese made in the north of Germany. This industry was introduced into Hungary by Swiss cheese-makers who have established themselves in the mountainous parts of the country and make handsome profits. Lately these cheese-makers have established their factories by preference in the western parts of Hungary, because in the South the demand for milk has increased, its price has gone up and turning it into cheese is not remunerative. The Emmental and Gruyère cheeses are for the most part made in the dairies at Répcelak, Bánóc and Nagyszécsény; the soft dessert cheeses are made at Sárvár, Pusztadör and Kisbér, and most of the Magyaróvár cheese at the cooperative dairies of Moson county.

The number of milk ewes is about three million. (In 1913 the total number of sheep was 6 600 000). Calculating on an average yearly production of 8.8 gals. per ewe, the total yield may be estimated at 26 400 000 gals., which, at 5.45 *d* per gal., are worth £ 600 000. The ewes' milk is used in the manufacture of Brindza or Liptó cheese (2), much esteemed abroad. In 1913, Hungary exported 55 486 cwt., of it, of the value of £ 126 873.

During the last ten years our exportation of milk and milk products has not kept pace with the increase of the production of milk, and this must be due to the increased home consumption of these articles. Only a short time ago, butter, especially in the provincial towns, was used only at dessert, whereas now it has become a popular article of diet.

The greatest consumer of milk is Budapest; its 900 000 inhabitants consume daily 66 000 gals., or about 0.6 pint per head. In the capital two great firms supply 33 000 gals. per diem; one, which delivers 26 400 gals., is organised on a cooperative basis; the other, which sells 6 600 gals., is a joint stock company. The farmers send their milk to one of the Budapest railway stations and sell it at 9 *d* and 9 ½ *d* per gal. The public pays 1s 2 ½ *d* per gal. for the best milk in bottles delivered at the consumer's house, and 1s or 1s 1*d* for milk in cans.

For the last three or four years, among the other large cities of Hungary, Temesvár and Nagyvárad have also started municipal dairies; but as the

(1) See No. 1029, *B.* Nov. 1914.

(*Ed.*)

(2) See No. 1669, *B.* Dec. 1912.

(*Ed.*)

initial difficulties are not yet overcome, we cannot give exact data on their results.

In Hungary the consumption of milk has considerably increased, especially owing to the anti-alcohol campaign. The daily consumption per inhabitant may be estimated at a little over half a pint; thus, taking the population of Hungary at 18 $\frac{1}{2}$ millions, the yearly consumption of milk is 446 million gallons, or 55 per cent. of the total amount of cow's milk produced.

Basing our calculations on the available data and taking into consideration the prices of concentrated foods, we have been able to determine the cost of production of milk in this country, which is set forth in the following table:

Cost of production of 1 gallon of milk.

Daily yield gals —	Corresponding cost — d
0.88	9.9
1.10	7.9
1.32	6.6
1.54	5.7
1.76	4.9
1.98	4.4
2.20	5.9
2.42	4.4
2.64	4.9
3.30	4.4

The Control of Plant Diseases in Sweden

by

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A. — INTRODUCTION.

Many years have elapsed since Sweden began to take measures for the control of plant diseases. The first step in this direction was made in 1876 by the appointment of a Botanist at the Experiment Station for Agricultural Chemistry attached to the Royal Academy of Agriculture and situated at Experimentalfältet near Stockholm. For the appointment of the Botanist the Swedish Riksdag had voted a sum in 1875, and this was renewed for a series of years. The Botanist had the duty of making, during the summer, botanical investigations connected with the experiments carried out by the Station of Chemistry. On December 17, 1876, the writer was named Botanist.

In 1886 a special Botanical Institute, that is to say the Experiment Station for Plant Physiology (Växtfysiologiska Försöksanstalten) was

founded by the side of the Chemical Station. In 1885 the Riksdag had voted the necessary yearly funds for it. The Botanist became the chief of the new station and was entrusted with the drawing up of the detailed regulations and instructions for the 16 State Seed Control Stations, which were approved, the former in 1886, the latter in 1888. The duties of the chief included also the inspection of these Stations during the years 1888 and 1889.

In 1889 there was a disastrous attack of rust on the oats in Sweden: the total crop of the whole country was about 160 000 tons below the average of the preceding ten years. According to a proposal of the chief of the Station, the Academy of Agriculture presented to the Government on January 20, 1890, the request that a sum of £ 550 be voted for new, thorough and extensive investigations into this rust during the years 1890 to 1892. On February 14 the Government granted the sum demanded and the work began immediately. As assistant for this investigation Dr. G. J. Henning was attached to the Station up to April 1894.

On June 22, 1905, the American gooseberry mildew (*Sphaerotheca mors-uvae*) was observed for the first time in a Swedish garden (at Blekinge in the south of Sweden). In a short time the disease spread to several other localities. In investigating the matter it was found that the disease had been introduced by means of gooseberry bushes which had been sent direct some years previously from a Danish nursery. A leaflet was immediately distributed to put farmers on their guard against the parasite. On September 22 the Government enacted a provisional law against the importation of gooseberry plants and fresh gooseberries into Sweden. At the same time the chief of the Station addressed to the Governments of all the countries of Europe in which gooseberries are cultivated, an appeal to put themselves on the defensive against the approach of the enemy. In the course of the following year (1906), the disease having invaded the neighbourhood of Stockholm, further measures were taken. The Government allocated a sum of £ 55 for the control of the fungus. On September 10 of the same year the Government prohibited, until further orders, the transport within the country of gooseberry plants or parts of plants, with the exception of the fruit. By means of articles in a great number of Swedish newspapers the public was warned of the danger that threatened this important crop. The most rapid and efficient measures were recommended for the eradication of the pest. Unfortunately this appeal remained without effect. During the succeeding years the disease spread more and more; at present it is frequent in most of the Swedish gardens. The laws against the importation and transport of gooseberry bushes were repealed in April 1910.

Since 1907 the Botanical Station has formed part of the Central Agricultural Experiment Station (Centralanstalten för försöksväsendet på jordbruksområdet) as Division of Agricultural Botany (Afdelningen för landtbruksbotanik). In 1907 also some changes were made as to the buildings, etc., of the Station. A new piece of land for experiments and a new building were placed at its disposal. Since 1914 the Division

disposes of an annual budget of £ 973 10s. Out of this sum the chief gets £ 410, with a periodical increase of £ 33 for seniority. The assistant receives £ 165, and the laboratory help £ 38 10s. For the experiments £ 357 10 s. are set apart.

On October 2, 1912, potato canker (*Synchytrium endobioticum* or *Chrysophlyctis endobiotica*) was observed in Sweden. Efficient measures were immediately taken to eradicate the disease, and apparently with happy results (1).

On October 1, 1913, I retired, having reached the age limit fixed by the law, and on April 24, 1914, my post was occupied by Mr. E. J. Henning, professor at the Ultuna College of Agriculture. Mr. C. T. V. Hammarlund is at present attached to the Division as assistant.

B. — WORK OF THE BOTANICAL STATION AT EXPERIMENTALFÄLTET.

a) *Various work.* — During the first years, several experiments of cultures in solutions were made with the object of investigating the influence of certain mineral salts, considered poisonous, on certain plants. But even as early as that some research on plant diseases was made.

At the same period popular pamphlets on various diseases were issued; such were papers on *Nectria ditissima*, on *Exoascus Pruni*, etc.; they were followed by the publication of special studies, for instance in 1879 on *Typhula graminum*, in 1880 on *Sclerotinia Trifolium*, in 1883 on *Cladosporium herbarum*, in 1884 on *Phytophthora injestans*, and in 1885 on *Sclerotium graminis*, *Phragmidium subcorticium*, *Sphaerotheca pannosa*, *Uncinula Aceris* and *U. Tulasnii*, *Asteroma radiosum*, *Fusicladium dendriticum* and *F. pinum*, *Morthiera Mespili* and others. In 1890 a summary of observations made in the course of several years on a great number of the diseases of various plants was published under the title of "Some diseases of cultivated plants and the means of controlling them".

Since 1890, the presence of parasitic fungi in the samples sent to the Station has been determined, and information as to the nature of the diseases and on the corresponding treatment is forwarded to the senders of the samples. Whilst the number of such samples rarely reached 100 before 1902, it has often been 300 and 400 during recent years. The highest figure was reached in 1907 when the number of reporters was 464 and the number of specimens and questions was 537.

Besides the above work, the officials of the Station have visited the various infected localities of the country to make investigations on the spot and to give farmers information and advice.

b) *Research on the rust of cereals.* — In 1894 and 1895 the first preliminary publications on certain results obtained during the years 1890-1893 appeared. In 1894: "Principal Results of New Investigations into the Rust of Cereals" (2), and in 1895: "On the Specialization of Para-

(1) See *B.* July 1913, p. 1006, and No. 18, *B.* Feb. 1914.

(2) According to the wish of the author, the titles of articles published in Swedish are here translated. (Ed.).

sitism in Cereal Rusts", "Favourable Influence of Cold on the Germination of the Spores of Certain Fungi", "Is the Rust-resistance of the Various Varieties of Wheat Constant or not?" were published.

A detailed account of the results obtained between the years 1890 and 1893 was published in June 1896 under the title "Die Getreideroste, ihre Geschichte und Natur, sowie Massregeln gegen dieselben". The 1894 Report and the detailed account of 1896 were written by the chief and the assistant of the Station together.

In a series of more or less ample works published successively, after new research, and written by the chief of the station, many subjects connected with the rust of cereals were examined in detail. Among these publications may be mentioned the following: in 1896, "Which are the Grasses which can communicate Rust to Barberries?", "New Research on the Specialisation, Propagation and Origin of Black Rust", and "Barberries Bearing and Propagating Rust"; in 1897, "Further Observations on the Specialisation of Black Rust", "New Observations on the Nature and Propagation of Crowned Rust", "Characteristics of the Brown Rust of Cereals", "On the Duration of the Capacity of Germination of the Winter Spores of Certain Kinds of Rust"; in 1899, "New Studies on the Brown Rust of Cereals"; in 1900 and 1901, "On the Origin and Spread of Cereal Rust by Means of the Seed"; in 1902, "Ist der Timotheengrassrost eine selbständige Rostart oder nicht?", "On the Specialisation of Cereal Black Rust in Sweden and in Other Countries"; in 1903, "On the Vegetative Parts of Yellow Cereal Rust"; in 1904 and 1905, "Ueber das vegetative Leben der Getreiderostpilze", I-IV; in 1905, "Zur Frage der Entstehung und Verbreitung der Rostkrankheiten der Pflanzen"; and in 1908, "Neue Studien über die Specialisierung der grasbewohnenden Kronenrostarten".

With the preliminary communication of 1894 mentioned above, and especially with the detailed report of 1896, the question of the rust of cereals entered upon a new phase.

From that moment it became evident that among the rusts attacking the common cereals (wheat, rye, barley and oats), six different species were to be distinguished, namely: *P. graminis*, *P. glumarum*, *P. dispersa*, *P. triticea*, *P. simplex*, and *P. coronifera*; and for the commonest grasses, the very similar rusts of which had always been regarded as identical with those of cereals, six other species: *P. Phlei-pratensis*, *P. bromina*, *P. agropyrina*, *P. holcina*, *P. Triseti* and *P. coronata*.

In the two above-mentioned publications, the principles of the specialisation of fungi were set forth and discussed. In one and the same species of fungus several different strains may be distinguished; these are distinct from each other from the biological point of view, and are called "specialised forms" (f. sp.): *P. graminis*, for instance, which attacks the four cereals and also a great number of grasses, includes among other forms the f. sp. *Avenae*, living on oats, *Dactylis*, *Alopecurus*, *Milium* and certain other grasses, but incapable of transmission to wheat, rye or barley.

In the full Report mentioned above, the whole life and cycle of evolution of the different kinds of rust, as well as the essentially different degrees of resistance of the various cereals to the various species of rusts, are described in detail.

The greatest care has been bestowed on the study of the hibernation of these fungi and the appearance of new outbreaks of disease on the following year's crop. It was believed that these two questions were completely solved by the existence of winter spores, and that these spores lived unchanged until the following spring, when they germinated and gave rise to new outbreaks of the disease. The new investigations did not, however, support this opinion generally accepted by the learned. The winter spores alone were not sufficient to solve the problem of hibernation. Numerous observations made in the course of several years led me to suspect the existence of an interior germ of the disease in the grain itself or in the young plant grown from it. These suppositions were presented to the public for the first time in the works that appeared between 1897 and 1900, and especially in the memoir "On the Origin and Spread of the Rust of Cereals by means of Seed" (1900-1901).

In these publications the hypothesis was advanced that the fungus was present in the cell of the host in a special state; that it lived under the form of a plasma, and that it contracted a kind of symbiosis with the protoplasm of the cell. It is this association which has been called "mycoplasma". At a certain period of development of the host plant, during a certain season, and when external conditions (heat, moisture, light, etc.), are favourable, the mycoplasma abandons its state of plasma, issues from the cell and forms a perfect spore-bearing mycelium giving origin to rust pustules.

In 1902 and 1903 this hypothesis was subjected to a scrupulous examination, in which the new methods of cytological preparation were applied. Dr. G. Tischler, lecturer at the Heidelberg University, took part in these investigations as collaborator during both summers. The results of this cytological investigation were published in a series of memoirs under the title "Ueber das vegetative Leben der Getreiderostpilze", I-IV (1904-05), in which the phases of the vegetative life of these fungi are described.

It was easy to foresee that a new theory as subversive as this would meet with opposition. This opposition led to answers on my part, published in the memoirs of 1904 and 1905, as well as in several special pamphlets, including the following: in 1903, "The Researches of Professor H. Marshall Ward on the Brown Rust of the Bromes and the Mycoplasma Hypothesis"; in 1910, "Ueber die Mycoplasmatheorie, ihre Geschichte und ihren Tagesstand"; "F. Zach's cytologische Untersuchungen über die Rostflecken des Getreides und die Mycoplasmatheorie"; in 1912, "Rostige Getreidekörner und die Ueberwinterung der Pilzspecies"; and in 1914, "On the Appearance of Rust Spores and Mycelium in the Seeds of Cereals".

c) *Studies on other kinds of rusts.* — In 1898 a note entitled "Study on *Puccinia Ribis*", containing the history of the development of this fungus, was published.

In 1896 appeared a pamphlet: "Some Observations on the Vascular Rust of Weymouth Pine". In this it is shown that the relationship existing between *Peridermium Strobi* and *Cronartium ribicola* is not always sufficient to explain the occurrence of this rust. On both kinds of host plants (*Pinus* and *Ribes*) the fungus can live from one year to another when one of the hosts is absent, or when the distance between them is 20 or 30 miles.

Hollyhock rust (*Puccinia Malvacearum*) has for a length of time been the object of very extensive research; the results are published in two Reports, one of 1911 under the title "Der Malvenrost, seine Verbreitung, Natur und Entwicklungsgeschichte", the other of 1914 bearing the title "Experiments of Immunisation of the Hollyhock against Rust". It appears from the first work that the reappearance of the disease on the new growth cannot be sufficiently explained by the fungus spores. Two forms of spores have been recognized, similar to each other morphologically but having a different way of infecting. The second work shows that the vitality of the fungus living in the latent state in the inside of plants, may be arrested or weakened by introducing a liquid fungicide into the roots of the host plant or by watering the soil in which the hosts live with a weak solution of sulphate of copper.

d) *Studies on other plant diseases.* — During the years 1898-1902 and 1911, a disease attacking several root crops and known under the name of *Rhizoctonia violacea* was studied. The results of these investigations were published in 1903: "Some Studies on *Rhizoctonia violacea* on Carrots", and in 1913: "Studies on the Disease caused by *Rhizoctonia violacea*" (1).

Since 1905 extensive research has been carried out on the American gooseberry mildew (*Sphaerotheca mors-uvae*). The results of these investigations are published in about thirty papers, among which we quote the following: in 1905, "The American Gooseberry Mildew in Sweden", "American Gooseberry Mildew, its Nature, its Propagation, and the Means of Controlling it"; in 1908, "Stachelbeermehltau und Stachelbeerkultur"; in 1909, "Einige Versuche das Winterstadium des amerikanischen Stachelbeermehltaues mit Fungiciden zu töten", "Die verschiedene Empfänglichkeit der Stachelbeersorten im Kampfe gegen den Amerikanischen Stachelbeermehltau".

Two of the most destructive diseases of fruit trees, *Monilia fructigena* and *M. cinerea*, have been the object of continued research (2). We may mention here the publication: "Zur Kenntniss der durch *Monilia*-Pilze hervorgerufenen Blüten- und Zweigdürre unserer Obstbäume".

On another equally destructive enemy of fruit trees, the apple mildew (*Podosphaera leucotricha*), a communication was made in 1908 in the paper: "Der Apfelmehltau und seine Bekämpfung".

A new disease which until then had not been observed, caused by

(1) See No. 426, B. April 1913; and B. July 1913, p. 1007.

(Ed.);

(2) See B. July 1913, p. 1007.

(Ed.).

Exosporium Ulmi, was the object of minute investigation during the years 1905 and 1906. The result was published in 1912 in a paper "Ueber *Exosporium Ulmi* n. sp."

During recent years several potato diseases have been studied. In 1912 the results of an examination of the felt disease of potatoes (*Hypochmus Solani*, *Rhizoctonia Solani*) were published in the article "Felt Disease of Potatoes" (1).

In order to ascertain the influence of a solution of formalin spread on the soil in which potatoes grew, on potato canker or black scab (*Synchytrium endobioticum* or *Chrysophlyctis endobiotica*) some special cultures in boxes were organized during the summer of 1913.

In 1912 a summary of the results of research carried out for many years on the diseases of beets was published. This work bears the title "Fungus Diseases on Swedish Beet Crops" (1). A more detailed report of one of the diseases (*Uromyces Betae*) mentioned in the said work, was given in 1914 under the title "Some Studies on Beet Rust".

A summary of research concerning the diseases of cucumbers (1) was published in 1913 in the work "Fungus Diseases of the Swedish Cucumber Crop".

In 1910 I published a manual bearing the title "Landtbruksväxternas Svampsjukdomar". In 1912 an English edition, revised and somewhat enlarged, appeared under the title of "Fungoid Diseases of Agricultural Plants". A German edition "Die Pilzkrankheiten der landwirtschaftlichen Kulturpflanzen" was published in 1913, and a French edition, "Les maladies cryptogamiques des plantes agricoles et leur traitement", in 1914.

e) *Efforts for the establishment of international collaboration with a view to controlling the diseases of cultivated plants.* — The idea of such an international collaboration was mooted for the first time in 1890 at the International Congress of Agriculture and Forestry at Vienna. At that time I presented a proposal aiming at an international agreement for the defence against such diseases. A great number of motions all tending to the same aim have been presented since at International Congresses: Paris (1900), Rome (1903 and 1905), Vienna (1907), Rome (1907 and 1908), Montpellier (1908), Rome (1909, 1910 and 1911), Paris (1912) and Rome again for the eighth time in 1913.

In view of an efficient control of plant diseases, a Bill was prepared for Sweden in June 1913, and the Swedish Government is having it examined.

But the most important diseases, those which are responsible for at least 90 per cent of the yearly losses, cannot be advantageously controlled by legislative measures. In a Report presented to the International Conference on Phytopathology (held in Rome from February 24 to March 4, 1914) and bearing the title "Phytopathological problems: the different diseases require different measures", I called attention to this important fact.

^{*}(1) See B. July 1913, p. 1007.

C. — WORK OF OFFICIAL BOTANICAL INSTITUTIONS.

At the Ultuna Agricultural College, near Upsala, prof. Henning has studied some fungi and insects injurious to crops; he has besides given advice and information as to the methods of controlling them and has published works on these subjects.

At the Alnarp College of Agriculture, near Lund, Prof. T. Hedlund has studied several parasitic fungi and especially those of root crops. He has also published reports on the results obtained by his research and he has distributed papers dealing with these subjects among farmers.

In connection with the extensive work for the improvement of seed carried out by the Svalöf Station for Seed Improvement (Sveriges Utsädesförening i Svalöf) several plant diseases have been studied. Reports upon this work have been published by officials attached to the Institution, and especially by Dr. H. Nilsson-Ehle and Dr. H. Tedin.

The State Forest Experiment Institution (Statens Skogsförsöksanstalt i Stockholm) has commenced of late years investigations in forest pathology. Memoirs concerning diseases of conifers and some other species have already been published. These publications are due to the Assistant of the Institution, Dr. G. Lagerberg.

SECOND PART.
ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION.

ORGANIZATION
OF
EXPERIMENTAL
AND
ANALYTICAL
WORK

1086 - Report of the Work of the Experiment Stations and Experiment Fields of Annam, 1913. — DEVRAIGNE, GEORGE (Chef des Services Agricoles et Commerciaux locaux de l'Annam) in *Bulletin économique de l'Indochine*, Year 17, No. 108, pp. 348-363. Hanoi-Haiphong, May-June 1914.

I. — *Experiments with industrial plants.* — The Caravonica variety of cotton was experimented with at the station of Hué. It is a resistant variety and makes good growth, but has the disadvantage that its pods reach maturity during the rainy season. Attempts will be made to remedy this as far as possible by suitable pruning. Kapok from Venezuela was very successful, whilst that from the Malay peninsula and Cambodia was less successful. The oil-yielding *Camelia* (1) was successful at the Yêndinh Station (north Annam), but it was not a success at the Hué station (South Annam), where the climate is very different. Amongst rubber trees *Ficus elastica* and the liana *Cryptostegia madagascariensis* have succeeded at Hué; *Funtumia elastica* was less successful and Hevea was a failure. *Arenga saccharifera* succeeded well at Hué and in groups of three the trees resisted the most violent winds and typhoons; it is fairly abundant in the forests of Annam and the fibres are used to a small extent by the natives. Camphor grows exceedingly well at Hué, and Kola nuts, *Merremia mamosa* and *Curcuma longa* were also successful.

II. *Experiments with food plants.* — In 1912 an orchard was established at Hué with native and exotic species, including bananas, shaddock,

(1) Various species of *Camelia* such as *C. drupifera*, *C. Sasanqua*, *C. theifera*, are used for the extraction of oil from the seeds. Cf. WATT, *Dictionary of Economic Products of India*. Calcutta.
(Ed.).

orange, mangosteen, pineapple, papaya, cacao, pepper, etc. Experiments on the cultivation and selection of rice have been in progress since 1906 at the Yên-dinh Station. The results obtained each year from 1906 to 1913 are summarised in tables by the writer. During the last year (1913, the variety "Lúa Chanh", an early hill rice, yielded 1242 lbs. per acre) whilst various selected swamp rices yielded from 1242 to 2737 lbs. per acre.

III. — *Animal breeding.*—At the Hué Station the acclimatisation of a breed of Kélanian sheep from Yên-dinh was very successful. The silkworm egg-breeding stations founded by the Government continue to increase: during 1913 they numbered 11 and distributed 636 293 batches of eggs.

CROPS AND CULTIVATION.

1087 — *The Climate of Ethiopia.* — EREDIA, F., and DE CASTRO, L., in *Bollettino della Reale Società Geografica*, Part VIII, pp. 845-884. Rome, 1914.

AGRICULTURAL
METEOROLOGY

There is little information concerning the climate of the high plateau of Abyssinia, the only data available being those of DOVE obtained in 1890 (*Kulturzonen von Nord Abessinien, Ergänzungsheft Nr. 97 zu Petermanns Mitteilungen*, Gotha, 1890), those published in the *Annales de l'Observatoire physique Central Nicolas*, Petrograd, 1898-1903; those collected by LYONS, etc. All these observations have the disadvantage of having been made during limited and irregular periods.

In October 1901 Dr. L. DE CASTRO established a meteorological station at Addis-Abeba, where he began a series of regular observations which, together with Dr. E. ODDONE, he continued until 1911. The data thus obtained have been examined by Prof. FILIPPO EREDIA and summarised in the accompanying table.

The difference between the highest and lowest mean monthly temperatures (18.7° and 14.6°) is very slight; thus the climate is mild and the mean temperature almost uniform throughout the year. The difference between the day and night temperatures, on the other hand, is very great and averages 15° C. The maximum daily temperatures during the hottest period are almost 35° C. whilst the night temperatures during the coldest months approach zero.

The rainfall shows a very distinct period of abundant rain from the last ten days of June until the second ten days of September, the highest rainfall being during the first ten days of August. This period of intense rain is followed by an interval where the rainfall is less abundant, beginning suddenly and lasting until the end of February. Extreme drought occurs in January, when no rain has ever been recorded during the first ten days. This period is followed by more abundant rains, which increase as the rainy season approaches. The rains may be divided into two classes: the less abundant and prolonged rains during the period of low rainfall and the more abundant short rains during the rainy season. The heavy rains are almost always accompanied by electrical disturbances,

which are particularly frequent in the afternoons. At the same time the wind is generally from the S or SW, whilst the storms come from the N or NE and sometimes from the E. The heavy rains should therefore be attributed to opposing currents of air, whilst light rains may be considered as entirely of orographical origin.

During the rainy season the predominant winds are N, W and NW.

Summary of the Climatological Data of Ethiopia.

(Temperatures in deg. C., rainfall in mm.)

Month.	Mean temperature				Extreme temperature		Rainfall		Fine days.	Relative humidity	Direction of predominant wind
	daily	max.	min.	range	max.	min.	quantity	No. of rainy days.			
January	15.5	24.2	6.8	17.4	28.0	3.0	12.5	3.8	22	53	SE
February	17.0	25.3	8.6	16.6	30.0	3.5	33.1	2.9	20	54	SE-E
March	18.3	26.3	10.3	16.0	29.5	5.0	67.7	9.7	15	67	SE
April	18.0	25.6	10.4	15.2	32.0	6.0	75.4	12.0	11	70	SE-E
May	18.7	26.7	10.7	15.8	33.0	4.0	75.9	9.1	15	58	E
June	17.7	25.3	9.9	15.4	34.0	7.0	128.9	20.9	8	73	SE
July	16.6	23.0	10.3	12.7	31.0	7.0	266.1	28.3	2	78	N
August	16.2	22.1	10.1	12.0	29.0	7.0	316.4	28.6	2	87	N
September	16.5	23.1	9.8	13.3	33.0	6.5	188.3	23.2	7	85	SE
October	16.6	24.8	8.4	16.4	33.0	4.0	18.2	3.9	20	63	E
November	15.0	23.3	6.8	16.5	27.5	1.5	21.3	2.5	23	53	E
December	14.6	23.1	6.0	17.1	28.0	0.0	8.8	2.2	24	48	E
Year	16.7	24.4	9.0	15.4	33.0	0.0	1212.6	148.1	169	66	SE-

There is also a distinct daily variation; in the mornings the E and S E winds predominate, changing to the N in the evening. The end of the period of heavy rains is marked by the predominance of N E and E winds, those of the S W and S disappearing almost completely.

The seasons are described as follows:

Winter (October, November, December): low temperature; little rain; high variation daily; minimum relative humidity; large number of fine days; prevailing wind E.

Spring (January, February): mild temperature; relative lack of rainfall; high daily variation; minimum relative humidity; large number of fine days; predominant wind: S E.

Summer (March, April, May, June): high temperature; relatively abundant rain; average daily variation; average relative humidity; few fine days; predominant wind S E.

Autumn (July, August, September): mild temperature; abundant rain; minimum daily variation; high relative humidity; very few fine days; predominant winds; N and S E.

The natives divide the seasons according to their rainfall, the four seasons in the above order being known as Tebbi, Hagai, Todi and Kerempt.

1088 - **The Estimation of Phosphates in Soil Extracts.** — PRESCOTT, J. A. (Rothamsted Experimental Station) in *The Journal of Agricultural Science*, Vol. VI, Part 2, pp. 111-120. Cambridge, May 1914.

SOIL PHYSICS,
CHEMISTRY
AND
MICROBIOLOGY

The method of estimating phosphates recommended by the United States Division of Chemistry, which consists in dissolving the phospho-molybdate precipitate in excess of standard alkali and titrating back with standard acid, was examined with regard to certain working conditions. It was shown that it is essential to avoid working at too high a temperature, 55° C. proving most favourable. The presence of silica also proved a disturbing factor and this substance should be precipitated in the preliminary phases of the estimation. Determinations made with solutions containing known amounts of phosphate yielded results 3 per cent too high when the calculations were based on the usual factor (1 cc. N_{10} alkali = 0.0003088 gm. P_2O_5) and it is therefore recommended that the factor 1 cc. N_{10} alkali = 0.0003004 be adopted, as it corresponds approximately to the constitution $48 Mo O_3 \cdot 2 P_2O_5 \cdot 5 (NH_4)_2O$ for the yellow precipitate.

Another method of estimating small quantities of phosphate was tried; it consists in converting the phospho-molybdate precipitate into lead molybdate and weighing it as such; it was found to be no more accurate than the titration method, while being less rapid.

1089 - **Azotobacter in Connection with Nitrification.** — HEADDEN, W. P. (Colorado Experiment Station) in *Science*, Vol. XL, No. 1028, pp. 379-381. Garrison, N. Y., September 11, 1914.

In certain pure cultures of *Azotobacter*, brown pigmentation was obtained; this tended to weaken and disappear in the successive generations. Where such pigmentation occurred a decided reaction was obtained with phenolsulphonic acid apparently indicating the presence of nitrates and consequently a power of nitrification on the part of *Azotobacter*. On further investigation, however, it was found that the colour reaction was due to the pigmentation and not to the presence of nitrates, thus destroying all evidence of nitrifying power on the part of *Azotobacter*.

1090 - **Overhead Watering Plant.** — DEAN, WILLIAM HARPER, in *The Country Gentleman*, Vol. LXXIX, No. 31, pp. 1309-1311. Philadelphia, August 1, 1914.

PERMANENT
IMPROVEMENTS.
DRAINAGE
AND
IRRIGATION

Among the many systems of irrigation, the overhead system presents several advantages, namely that it can be used on sloping uneven ground where surface irrigation would be difficult to apply, that it can be used to distribute liquid manures, and that sprays for the control of plant diseases and injurious insects can be applied easily, evenly and efficiently.

The writer, in company with the U. S. Government irrigation engineer in charge of irrigation investigations in the States east of the Mississippi,

visited some farms irrigated on this system and reports upon two among the most successful of them.

The first is situated in Central New Jersey. It is a farm in which 9 acres are irrigated by this system and 19 by surface irrigation; most of the land is under strawberries and orchards. The water is pumped up from a river by a 24 HP. gasoline engine. The pumping plant, pump house and connection to the mains carrying water to the fields cost \$778. The rest of the irrigation plant for the first five acres cost, in 1910, \$1162 distributed as follows:

Pipe materials all galvanised	\$ 852
Freight on pipes and incidentals	25
Patented fittings	143
Posts for spray lines	52
Day labour at \$ 1.25 per day.	50
Plumber at \$ 3 per day	40
	<hr/> \$ 1162

The second part of the installation for the next 4 acres cost \$1438.

From the pumping plant a 5-inch galvanized steel main carries water under 30 or 40 lbs. pressure to the overhead pipes. These pipe lines are 425 feet long and 50 ft. apart, supported every 40 ft. by upright steel pipes. In order to ensure the same pressure throughout, the diameter of the pipes varies from 1 1/2 inch to 3/4 inch.

By a slight turn of a lever the whole length of these pipes may be turned to change the angle of the tiny spray nozzles that are situated four feet apart in each pipe; roller bearings on each line make this possible. During irrigation the angle of these nozzles has to be changed seven times to get the rain evenly distributed over the space between the lines.

This system supplies 40 gals. a minute to the acre; it would put an inch of water on the land in about 12 hours.

The second farm visited is situated in Southern New Jersey; it covers 35 acres, 10 of which under overhead irrigation. The land is level and the soil a light, poor sand.

The water is pumped up from a creek by a 12 HP. gasoline engine and is distributed at 20 lbs. pressure. The overhead lines are 250 feet long and 50 ft. apart. The supports are 20 ft. wooden posts 125 ft. apart: from the tops of these poles were stretched cables from which are suspended the spray pipes by means of other wires. Twelve gallons a minute is the output through the nozzles for the first half of each spray line, and half of this for the second half, at which rate an inch of rainfall can be put on in 12 hours.

The average cost of the plant is \$250 per acre. Depreciation is very low being chiefly limited to the pump and engine and to the wooden supports for the spray lines.

In this farm concentrated Bordeaux mixtures or Paris green wash pumped into the system of pipes while clear water is running through, and in 20 minutes 1 1/2 acres can be sprayed. Liquid manures are applied in the same way.

1091 - Irrigation Scheme for Sind; The Development of Cotton. — SUMMERS, T. (Proceedings of the East-India Association), in *The Asiatic Review*, Vol. V, No. 11, pp. 298-330. London, October 1914.

The low productivity of this large tract of the Indus Valley appears to be due to the low rainfall, which varies from 2 to an average of 6 inches. The soil of the Sind consists of alluvial silt deposited by the Indus, and in former times (about 500 B. C.) its fertility was increased by an excellent irrigation system which enabled it to support a much greater population.

At the present time, a few canals exist only on the lowest tracts, only one-fourth of the area is cultivated, the cultivators lift comparatively siltless water on to their fields at a cost of 5 rupees or more per acre, and a population of 800 000 persons cultivates only 600 000 acres.

The writer describes a scheme, known as the Rohri Canal Project, which, if carried out, will bring into cultivation between one and two million acres of this fertile land, of which half to three-quarters of a million acres will be suitable for cotton and capable of supporting twenty or thirty cotton mills.

The cost of this scheme is estimated at about 10 millions sterling and at the present rate of assessment the net annual profit to the Government would amount to between $\frac{1}{4}$ and $\frac{1}{2}$ a million sterling.

1092 - Experiments in Tilling the Soil by Means of Explosives. — I. SPRING, F. G. Dynamite Experiment. — *The Agricultural Bulletin of the Federated Malay States* Vol. II, No. 11, pp. 297-299. Singapore, June 1914. — II. DURHAM, HERBERT E. On the Use of Explosives in the Garden, in *The Journal of the Royal Horticultural Society*, Vol. XL, Part I, pp. 7-18. London, August 1914.

TILLAGE AND
METHODS OF
CULTIVATION.

I. In October, 1913, some experiments were made at the Experimental Plantation, Kuala Lumpur (Federated Malay States), on the use of explosives in rubber cultivation. The land on which they were carried out is of a poor laterite nature and the rubber plants were very backward in growth. The results are those hitherto obtained from an area subjected to gelignite charges.

Three parallel rows of rubber, each containing 34 trees, were selected; on one the explosive was used, while the other two were kept as controls. The cartridges were placed at a depth of $2\frac{1}{2}$ feet below the surface of the ground, one cartridge between two trees $12\frac{1}{2}$ feet apart. The method of firing was by means of fuses and detonators.

The average increase of girth measured on June 9, 1914, was 2.56 inches in the dynamite row and 1.81 and 1.62 in the control rows. The cost of applying the explosive is 15 cents per charge, inclusive of labour. One charge per tree is generally allowed. The results would have been more evident if the subsoil had been of a clay nature, as is the case at Castleton Estate, where an experiment on a much larger scale is being conducted.

II. The writer wished to ascertain whether explosives can be used for loosening the subsoil on small areas, such as gardens intensively cultivated, and near buildings. He used "cheddite" cartridges with 2 oz., $1\frac{1}{2}$ oz., 1 oz. and $\frac{1}{2}$ oz., charges placed three feet apart and at a depth of three feet. One piece of the ground had recently been double dug before the exploding

and it was obvious that much of the force which would have been utilized if the ground had not been spaded was wasted.

Compared with the control plot not loosened by cheddite, the potato *Crimson Beauty* showed that the response to the explosive was very marked. Thus the $\frac{1}{2}$ oz. charges gave about 15 per cent. increase, the 1 oz., 43 per cent and the 2 oz. about 88 per cent. Cauliflowers and cabbages showed no appreciable difference on exploded and unexploded ground. With peas the number of plants was much smaller on the unexploded side, on which they blossomed and matured a week earlier than on the exploded ground. Carrots, onions and scorzoneras gave a greater number of plants, and germinated and developed much better on the exploded ground; with the latter plant especially the crop was much increased by the explosive. With asparagus the shoots were not far from having been doubled in length.

As for the cost: at wholesale prices, four or five 2 oz. shots including fuse and detonators can be had for a shilling. With regard to the energy, developed by cheddite, allowing 50 per cent loss of the total available energy a 2 oz. charge gives about 50 400 foot-pounds in the soil, that is quite ten times as much energy as would be put into the soil by using the spade to a depth of three feet.

MANURES
AND
MANURING

1093 - *The Relative Effect of Lime as Oxide and Carbonate on Certain Soils.*—HUTCHINSON, H. B., and MAC LENNAN, K., in *The Journal of Agricultural Science*, Vol. VI, Part 3, pp. 302-322, plates IX-X. London, September 29, 1914.

To make a further study of the hitherto not fully known mechanism of the changes wrought by caustic lime in the soil, five soils of widely different type were taken:

1. *Rothamsted soil*, a poor stiff clay containing 7.72 per cent of organic matter (loss on ignition) and 1.94 per cent of CaO.
2. *Chelsea soil*, a black sandy soil containing 14.32 per cent of organic matter and 1.42 per cent of CaO.
3. *Craibstone soil* (Scotland), a light soil, rich in organic matter (14.55 per cent), with 0.41 of CaO.
4. *Millbrook soil* (Woburn), a very light sandy soil, poor in organic matter (4.46 per cent), with 0.26 of CaO.
5. *Woburn soil*, an open sandy loam, which has been rendered distinctly acid by annual applications of sulphate of ammonia for the last 37 years; it contains 4.58 per cent of organic matter and 0.56 per cent of CaO.

Laboratory Experiments.—The soils were passed through a 3 mm. sieve and filled into bottles in lots of 900 gms. A set of bottles from each soil was set aside as control, and the others received calcium oxide in the proportion of 0.1, 0.2, 0.3, 0.4, 0.5 and 1.0 per cent, while calcium carbonate was added to another lot to the extent of 1.0 per cent, with the exception of the Craibstone soil, where applications of 0.3, 0.6 and 0.9 per cent of carbonate were made. The water content was made up by means of sterilized water to 18 per cent. A set of bottles was taken immediately after the end of this ten-day treatment, and the others were stored, provided with cotton wool plugs, at room temperature. The various soils were examined once a month; the number of bacteria was determined, as well as the

amount of ammonia and nitrates produced. Examinations for protozoa were also made.

Pot experiments — The soils were passed through a 3 mm. sieve previous to being filled into glazed earthenware pots (in which loss by drainage was prevented) at the rate of from 8 to 10 kg. of soil per pot. Lime as oxide and carbonate was applied in the same ratio as in the laboratory experiments. The surface soil was then wetted with 100 cc. of water in order to allow of efficient action of the caustic lime before it became carbonated. Ten barley seeds were sown in each pot, and after about a month the plants were thinned out to five per pot. Equal numbers of the seedlings were weighed to ascertain the initial effect of the lime on plant growth.

The results are given in numerous tables and diagrams and are summarized as follows:

Caustic lime is found to have two distinct effects on the soil:

- 1) A partial sterilisation effect.
- 2) A chemical action, decomposing some of the soil organic matter.

The amount of caustic lime necessary to induce specific changes in the flora and fauna of the soil depends very largely upon the character of the soil. The light sandy Millbrook soil, poor in organic matter and in carbonate, reacted sharply with 0.2 to 0.3 per cent. caustic lime; the Rothamsted clay soil, poor in organic matter but rich in carbonate, was found to react to 0.3 to 0.4 per cent; the acid Woburn soil required between 0.5 and 1.0 per cent, as did also the rich Chelsea garden soil, which already contained carbonate; the Craibstone soil, with a high organic and a low carbonate content, failed to react even to applications of 1.0 per cent caustic lime.

Each of these soils, as well as many others examined, appears to absorb directly a definite amount of caustic lime, and until these requirements are fully satisfied the partial sterilization phenomena do not set in. These phenomena include a sudden initial decrease and subsequent increase in the numbers of bacteria, the extinction of the larger forms of protozoa and the inhibition of nitrate production. Lower doses than those required for partial sterilisation induce a temporary suspension of nitrification, and consequent accumulation of ammonia, for periods varying with the amount of lime and the character of each soil; they also lead to a temporary increase in numbers of bacteria capable of growing on gelatine plates, but these afterwards decrease, until the level of the untreated soil is reached.

Caustic lime causes chemical breaking down of some of the organic matter of the soil, as shown by the ammonia formed during periods when soil bacteria are quiescent; when, however, bacterial growth commences, there is a large increase in the rate of ammonia production.

The return in nitrogen, as ammonia and nitrate for each increment of lime applied, varies with the character and reaction of the soil and the carbonate content. On the average, and within a period of about 250 days, it amounted approximately to 1.0 per cent by weight of the caustic lime applied. Carbonate gave less returns, apparently because of its relative inaction on soil organic matter.

The pot experiments show amounts of available nitrogen in the soils comparable with the amounts of ammonia and nitrate produced in the laboratory experiments. In some cases the amount of caustic lime applied was sufficiently large to check the growth of bacteria and to depress plant growth in the first crop, but in the case of the Chelsea soil the bacteria were active but plant growth was depressed, a phenomenon not yet satisfactorily explained.

As in other experiments, inhibition of nitrification resulting from applications of lime leads to a higher nitrogen content in the plants. This has been ascribed to the assimilation of nitrogen compounds other than nitrates, and, if occurring to any extent, involves an uneconomic utilisation of soil nitrogen. Where the amount of lime does not check nitrification, as in the case of the lighter dressings to the Craibstone soil, the nitrogen content of the plants is about the normal.

1094 — **The Duration of the Action of Manures.** — HALL, A. D., in *The Journal of the Royal Agricultural Society of England*, Vol. LXXIV, pp. 119-126. London, 1913.

A set of experiments was started at Rothamsted in 1904 in order to obtain practical information on the duration of action of manures. It took the following form: for each manure five plots were set aside; one was a check plot which at no time received the manure under investigation; of the other plots, one received the manure in 1904, but remained unmanured in 1905, 1906 and 1907; a second plot was manured in 1905, but not in 1906 and 1907; the third in 1906, but not in 1907; the fourth in 1907. Thus in 1907, by which year the experiment was in full swing, there was a plot that had been manured in that year, another that had been manured in the previous year, a third two years previously, and a fourth three years previously. In 1908 it was considered that the manure applied in 1904 to the first plot had been exhausted by the four crops grown with it, and the manure was renewed on that plot; on the second plot it was renewed in 1909, and so on. The field was farmed on a rotation of alternating corn and roots and contained eight sets of five plots as follows:

Nitrogenous manures:

1. Dung made from roots and hay only.
2. Cake-fed dung.
3. Shoddy (wool waste).
4. Peruvian guano.
5. Rape dust.

Phosphatic manures:

6. Bone meal.
7. Superphosphate.
8. Basic slag.

Once during each rotation a dressing of superphosphate and sulphate of potash was applied equally to all the nitrogen plots; similarly for the corn crops a dressing of sulphate of ammonia was given alike to all the phosphatic plots. The unmanured plot in each series was so placed in the line that together they formed two diagonals across the field and the mean

of the first five was used for comparison in the case of nitrogenous manures, the mean of the last three as the standard for the phosphatic plots.

The results are considered under three headings.

1. *Residual values of rich and poor dung.* (1) — In the year of application, the cake-fed dung showed a great superiority over the roots and hay dung, but this superiority was much less manifest the second year and entirely disappeared the third and fourth year, though the effect of the dung persisted in both cases, raising the yield above that of the unmanured plot. These results are due to the fact that both kinds of dung contain approximately the same amount of insoluble nitrogen, while the cake-fed dung is richer in ammonia and amides, the effect of which had completely disappeared after the second crop.

2. *Other nitrogenous manures.* — The relative total produce of the other three nitrogenous manures is given below, the unmanured plot in each case being taken as 100.

	Year of application — Mean of 9	1 year old residue — Mean of 8	2 year old residue — Mean of 7	3 year old residue — Mean of 6
Shoddy	139.7	125.2	116.1	106.7
Peruvian Guano	150	101	96.5	94.4
Rape dust	136.2	100.4	100	94.4

A marked contrast exists between the shoddy on the one hand and Peruvian guano and rape dust on the other. The shoddy evidently contains compounds of nitrogen subject to comparatively slow decay, so that its effect in the second and succeeding years is considerable, there being a distinct increase indicated in the fourth crop grown with the manure. Indeed, the values yielded by shoddy compare very closely with those obtained with farmyard manure made from roots and hay only. It is a persistent manure that exerts in the first year of application less than one-half of its total effect. Doubtless we should include in the same category all manures made from hair, fur, skin, silk, hoofs, horns, etc.; and probably also the nitrogen compounds of bones.

Very different are the results yielded by Peruvian guano and rape dust. For both these manures the return in the first season is high; they are well-known as active and effective nitrogenous fertilizers; but the experiments show that they leave no residue possessing any value for succeeding crops. Owing to the limited number of experiments, too much stress cannot be laid on the actual figures obtained, but it may be concluded that the nitrogenous residue from Peruvian guano or rape cake after a crop has been taken will give less than 10 per cent. increase in the second crop, and after that

(1) See No. 15, B. Jan. 1914.

will be completely exhausted. (It should be noted that this statement applies to the nitrogenous part only of these manures, not to the phosphates they contain). Now the nitrogen compounds in question are, in the guano, ammonium compounds, uric acid and its derivatives, and some proteins; in the rape cake, almost entirely proteins; and it is a point of great importance in this connection thus to find that proteins are as active and as temporary in their action as ammonium compounds. Such a result is indeed intelligible, for the true proteins are readily and completely digestible, are equally easily attacked by bacteria, and pass thereby into ammonia and kindred bodies with great rapidity. There is other evidence from the Rothamsted experiments that the nitrogen in rape cake is, pound for pound, very nearly as immediately effective as the nitrogen in ammonium salts. The proteins thus fall into line with nitrates, ammonia, urea, etc., as compounds which produce all their effect in the season of their application, and leave little appreciable residue behind, in contrast to the collagens (the insoluble nitrogen compounds of wool, skin, bone, etc.) and to the indigestible residues of food. With this distinction in mind, the residual value of the nitrogen in other fertilizers can be roughly estimated: in cakes and seed residues it will be present in the form of protein; in fish guanos, it will be mainly protein; in meat guanos, protein and collagen, the latter predominating the poorer the manure becomes and the more it approximates to bone meal. Though these conclusions are based on experiments on the Rothamsted soil alone, it is one that would usually be considered retentive of manure, being both heavy and cool, fairly supplied with rain but not waterlogged.

3. *The phosphatic fertilizers.* — The following table shows the relative total produce yielded by the three phosphatic fertilizers, the unmanured plot in each case being again taken as 100.

	Year of application Mean of 9	1 year old residue Mean of 8	2 year old residue Mean of 7	3 year old residue Mean of 6
Superphosphate	116.2	109.1	113.8	107.8
Bone meal	114.6	112.4	109.1	105.6
Basic slag.	114.5	110.5	104.8	112.0

These results are significant in two directions: 1) that the phosphatic manures persist in the soil, and the residues exert an effect roughly proportional to the amount of phosphate unused; 2) that superphosphate is as lasting a manure as either bone meal or basic slag. These conclusions are perhaps limited to a soil like that of Rothamsted reasonably well furnished with carbonate of lime, so that the compounds formed in the soil by the soluble phosphoric acid will be mainly those containing lime. With regard to the original object of these experiments, it is clear that the

compensation to be paid for a dressing of phosphatic manure must be spread over a longer period than that given for most kinds of nitrogenous fertilizers.

Phosphatic manures are usually applied in considerable quantity; with the ordinary dressings it may be assumed that at least one-half of the original value of the manure remains in the soil after the first crop has been taken, and compensation to that extent should be given to the outgoing tenant, always assuming that the soil is one needing phosphatic fertilizers, so that the original expenditure was justified. When phosphatic fertilizers are used on suitable grass land, the scale of compensation should be even higher and should last for more than four years, because of the cumulative change wrought in the herbage as well as the actual phosphoric acid left behind.

1905 - Prohibition of Collection of Guano in the Ballestas Islands, Peru. — *La Riqueza Agrícola*, Vol. IV, No. 27, pp. 161-163. Lima, Peru, 1914.

Owing to the steadily increasing consumption of manures in the development of Peruvian Agriculture, it has been necessary to restrict the exportations of guano from the country (1).

In 1890 the Peruvian Corporation obtained the rights of exploiting the existing deposits, but later deposits were reserved to the native cultivation. As the demand for guano increased in Peru, owing either to the exhaustion of the soil in cultivation or to the extension of the area of land under cultivation or to the adoption of more intensive methods, or to the better education of the rural classes, the simultaneous exploitation of the guano deposits presented great difficulties, since the agricultural interests, which had insufficient command of labour, were injured by the Peruvian Corporation which extracted the largest quantity of guano with the highest percentage of nitrogen. As a result of this, by decree of the 25th February 1909 (promulgated for that particular year but which remained in force until 1914) the guano deposits were divided into two zones: north of Callao for the "Peruvian Corporation" and south of Callao for the country requirements, except the Ballestas Islands and Lomita Point, which were included in the first zone. This decree however did not remedy the unfair distribution of the product, to the detriment of the agricultural community, as shown in the following table.

This table shows that the Peruvian Corporation extracted six times the quantity of guano obtained for the agricultural community of the country.

Consequently a new Government decree of February 5, 1914 declared the deposits of the Ballestas Islands to be reserved for the three years, after which period they are to be worked for the benefit of the farmers.

This is considered to be the first step towards supplying the needs

(1) See B. February 1914, No. 107. — Also: International Institute of Agriculture. *Production et Consommation des engrais chimiques dans le monde*. 2nd Edition, 1914.

Yield of Guano from the different zones.

Year	by the Peruvian Corporation		for the farmers of the country
	Ballestas Islands	Total	
	tons	tons	tons
1909	5 342	23 236	2 708
1910	6 650	24 403	4 109
1911	7 700	22 377	3 168
1912	4 272	16 865	4 176
	23 964	86 881	14 161

of agriculture in Peru with all the guano it requires, as is contemplated by art. 21a of the contract cancelling the external debt of 1890, which granted the right of exportation to the Peruvian Corporation.

1906 - Recent Inoculation Experiments on Virgin Sphagnum-Moor Soils, with Various Cultures of Bacteria of Leguminosae. — VON FEILITZEN and NYSTRÖM in *Journal für Landwirtschaft*, Vol. 62, Part 3, pp. 282-283. Berlin, October 1, 1914.

The writers conducted at the Swedish Moor Experiment Station at Jönköping comparative inoculation experiments with inoculated earth, with earth cultures of Kühn's Nitragin, with earth cultures of Simon's Azotogen, and with Earp-Thomas' American Farmogerm. The experiments were carried out in a greenhouse in unglazed stoneware pots, each of which was filled with 33 lbs. of virgin undecomposed sphagnum peat fresh from the pit, all precautions having been taken to prevent any infection by contact.

For every special inoculation, five parallel pots had been prepared and manured at the rate of 4460 lbs. of slaked lime, 357 lbs. of superphosphate, and 357 lbs. of 38 per cent. potash salts per acre.

The plants grown were yellow lupins. The seeds were sterilized by being steeped for 5 minutes in 90 per cent. alcohol and then dried aseptically. The lupins developed quite normally and yielded the following amounts of green stuff per pot:

Not inoculated	347	gram
Inoculated with inoculated soil	541	»
» » Nitragin	583	»
» » Azotogen	601	»

The effect of inoculation was thus very marked, and the yield of lupins was nearly doubled. On the average, Azotogen gave the best, while Farmogerm gave the smallest results. The difference between the first three substances was so small, that considering also the differences in the parallel pots, it is not possible at present to give the preference to one rather than to another.

The examination of the roots showed that Farmogerm had caused much less abundant formation of nodules than the other substances employed.

1097 - **The Consumption of Fertilisers in South China.** — CARLETON, A. E. (Vice Consul General, Hongkong), in *Daily Consular and Trade Reports*, Year 17, No. 214, p. 1404. Washington, September 1914.

The consumption of manures, both natural and chemical, in China has not materially increased in the last few years, but the prospects are rather in favour of an improvement for the future. A large amount of money has been spent already in demonstrating the advantages to be derived from the use of proper manures, and many farmers in the delta of Canton and elsewhere have been supplied with fertilisers free of charge in order that they might see for themselves the efficacy of modern methods.

A considerable trade in bird manure has developed in Canton and the neighbourhood, and it is estimated at about \$ 175 000 per annum. This class of manure is sold at about \$ 1.75 per picul of 133 $\frac{1}{3}$ pounds.

A considerable amount of natural manure is exported to China from Macao (Portuguese Colony), the total trade in 1912 being over \$ 80 000. To these manures must be added a certain per cent of bean cake which comes from North China. The trade of Chilian nitrate of soda is on the increase, although the total imports into Hongkong amounted last year to only about 1 500 tons. This manure costs c. i. f. Hongkong about \$ 50 per ton. This high price has restricted its use to market gardening purposes and for manuring mulberry trees. The Chinese Government treats nitrate of soda as dangerous goods like gunpowder and it is necessary to obtain a permit from the central government for its importation.

The duty on nitrate is about \$ 0.17 per 100 lbs. Sulphate of ammonia comes chiefly from England and Germany, and the importations amount to about 1500 tons per year; the c. i. f. price Hongkong is about \$ 4.25 per picul. This fertiliser is used mostly for rice but in a very small way, as the price is prohibitive for the Chinese farmers. A very little guano is imported from islands in the Pacific. It is said that a Chinese company intends to work the deposits in Pratas Islands. Most of the phosphate output of Christmas Island goes to Australia and that of Ocean Island to Japan.

The total value of manures, including chemical manures, imported into China during 1912, was \$ 503 205 and in 1913 \$ 700 872 (1).

1098 - **Fractional Analysis of Wheat.** — BARBIERI, N. A., in *Comptes Rendus hebdomadaires des Séances de l'Académie des Sciences*, Vol. 159, No. 7, pp. 431-434. Paris, August 17, 1914.

By the successive action of various neutral solvents on 44 lbs. of wheat (*T. turgidum*) ten distinct fractions including the ash were obtained.

1st *Fraction*: Washing with distilled water; the slightly coloured solution is concentrated on a water bath after filtration; on treatment with chloroform the mixture separates into two layers, an aqueous solution above and a chloroformed solution below.

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(1) See: The International Movement of Fertilizers. B. Sept. 1914.

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2nd *Fraction: Maceration.* — The washed grains remain for 15 hours in chloroformed distilled water; they are then stirred and filtered. This highly coloured solution, is concentrated on a water bath and treated with chloroform, when it separates into two layers as above.

3rd *Fraction: Extraction with hot water* (at 50°-60° C.) so as to soften the completely macerated grains, without breaking the periderm. The solution is concentrated on a water-bath and precipitated by means of strong alcohol, the precipitate being separated by filtration.

4th *Fraction: Extraction with boiling water.* — The softened grains are boiled for one hour, causing them to swell and break. The liquid is then filtered through a porcelain filter, concentrated on a water bath and precipitated by means of strong alcohol, the precipitate being separated by filtration.

5th *Fraction: Sifting.* — The swollen grains are sifted and treated with strong alcohol, which dehydrates and disintegrates them into a white homogeneous finely granular mass, which has the appearance of a meal without bran, obtained by coagulation with alcohol without mechanical means. This meal is separated from the alcoholic liquor by filtration.

6th *Fraction: Pericarps and germs* —. The two epidermal layers and the germ remaining behind on the sieve are extracted with strong alcohol and filtered.

7th *Fraction: Chloroformed solution.* — The preceding solutions in water and alcohol are mixed and distilled until free from alcohol. The residual aqueous solution is concentrated on a water-bath, filtered and treated with chloroform. The two layers thus formed are separated by decantation. The lower chloroform solution is mixed with the preceding chloroform solutions and distilled. The residue is extracted with ether, the solution filtered and the ether distilled. The residue is then extracted with absolute alcohol, the solution is filtered and evaporated in vacuo to dryness, leaving about 2 gm. of a yellow colouring matter known provisionally as *bleine*, which is probably a physiological transformation product of chlorophyll. It does not give the biuret and acrolein reactions, is insoluble in water, but soluble in benzene, carbon disulphide, petroleum ether, etc.

Alcohol is added to the aqueous solution until a slight cloudiness appears. It is then dialysed and the dialysed liquid is concentrated on a water-bath. On the addition of excess of acetone, two salts, monopotassium phosphate and potassium sulphate, are precipitated and purified by dialysis and reprecipitations.

These salts have been obtained by extraction from wheat grown on land which has not received mineral manures for a considerable time. Analysis of the dialysed salts shows the absence of chlorides and monocalcium phosphate.

8th *Fraction: Ethereal solution.* — The flour, seed-coats and germs, and the first two precipitates free from alcohol, are extracted with ether. The ethereal solutions are filtered together and distilled, leaving 225 gms. of an oily residue, which, when treated with acetone, is separated into two parts, one soluble, the other insoluble; they are separated by decantation.

The insoluble portion consists of 211 gms. of an oil insoluble in alcohol and free from phosphorus, sulphur, nitrogen and ash, and 6gms. of stearin. The acetone-soluble portion contains traces of bleine, palmitin, and oleopalmitin, and traces of phosphates that can be separated by dialysis with ether.

The fact that the total phosphorus of a complete ethereal extract of wheat is found only among the products of treatment with acetone and that the supposed lecithins are insoluble in acetone, would appear to prove the absence of lecithin from wheat, as previously stated by the writer (*Comptes-Rendus*, 1st August 1910).

9th and 10th Fractions: Insoluble ash. — 1 kilogram of the flour from the 5th extraction is well dried and incinerated with 1 kilogram of seed-coats and germs. This ash contains the insoluble salts of the flour, 0.30 per cent, and the insoluble salts of the pericarp and germs, 0.62 per cent. They consist chiefly of calcium sulphate and tri-calcium phosphate. Carbonates are entirely absent.

Former determinations of the mineral matter of plants were entirely based on studies of the ash. The amounts of acids and bases were determined and the salts were estimated by calculations from these figures without recognising the many changes induced by the high temperatures during incineration. By means of the methods described above all the soluble salts can be separated by dialysis and the insoluble ones, which probably the high temperatures do not affect, by incineration.

1099 - **Studies on the Mulberry Leaf.** — I. Chemical composition of mulberry leaves attacked by *Diaspis* and of healthy leaves. — II. Chemical composition of mulberry leaves in the morning and evening. FIGORINI, I., in *L'Italia Sericola*, Year I, No. 5, pp. 1-3; No. 6, pp. 11-12. Milan, September and October 1914.

I. No extensive and systematic researches have been hitherto undertaken with the object of establishing the relation between the chemical composition of mulberry leaves and yield of silkworms. It is generally admitted that the chemical composition of the leaf has considerable effect on the quality of the silk, and according to ABDERHALDEN and DEAN the amino-acids are of most importance in this connection.

The leaves chosen for the experiments by Prof. VERNON were very seriously damaged by *Diaspis*. Control leaves were taken from trees of the same age but free from the disease owing to severe pruning and the presence of *Prospaltella berlesii*. It should be noted that the leaves were gathered in the beginning of June at 8 a. m. during dull weather, seeing that leaves are much richer in substance at the end of the day after exposure to sunshine.

The 200 diseased leaves subjected to analysis weighed, without petioles, 200.3 gms. while the 200 healthy control leaves weighed 205.6 gms. The results of the analysis are shown in the following table :

Table I. — *Composition of the leaves.*

	Healthy trees	Diseased trees
	per cent	per cent
Water	73.4	68.6
Dry matter at 100° C.	26.6	31.4

100 parts of dry matter at 100° C. contain :

Ethereal extract	3.41	3.87
Crude fibre	12.78	11.34
Ash	12.70	10.54
Total nitrogen	4.19	3.05
Proteid nitrogen	3.78	3.04
Non-proteid nitrogen	0.41	0.46
Percentage of non-proteid nitrogen in total nitrogen	9.78	13.17

100 parts of the fresh leaves contain :

Water	73.4	61.6
Dry matter at 100 °C.	26.0	31.4
Ethereal extract	0.9	1.2
Crude fibre	3.4	3.56
Ash	3.37	3.30
Total nitrogen	1.11	1.09
Proteid nitrogen	1.005	0.954
Non-proteid nitrogen	0.109	0.144
Percentage of non proteid nitrogen . .	9.82	13.21

No general conclusion can be drawn from this analysis as to the greater or less value of the diseased mulberry leaves, since no account has been made of the amounts of sugar, starch and other substances such as pentosans which can be utilised by the silk worms to a greater or less extent. The following conclusions however may be drawn :

- 1) The leaves attacked by the *Diaspis* become thicker, tougher and almost coriaceous and seem therefore less digestible than healthy leaves.
- 2) The low percentage of water is not conducive to their easy digestion and assimilation.
- 3) The total nitrogen and protein of the dry matter is considerably less in the diseased leaves.
- 4) The percentage of fatty matter, on the contrary, is increased.
- 5) crude fibre is more abundant in the fresh leaves of the diseased plants.

Thus, healthy mulberry leaves have a greater food value than those diseased, though the differences may not be sufficiently great to justify the rejection of diseased leaves as food for rearing silkworms.

II. — For these experiments leaves were collected on land belonging the Royal Silkworm Station of Padua, at sunset after five days during which the leaves had had good exposure to sunlight, and at daybreak.

TABLE II. — Chemical composition of mulberry leaves of the variety *Limoncina* collected during the first days of September,

	Morning		Evening	
	Percentage of dry matter	Percentage of fresh matter	Percentage of dry matter	Percentage of fresh matter
Water	—	68.419	—	63.156
Dry matter at 100° C. . . .	—	31.581	—	34.844
Ethereal extract	5.521	1.743	5.443	1.880
Total nitrogen	2.445	0.772	2.534	0.883
Proteid nitrogen	2.309	0.729	2.368	0.824
Non-proteid nitrogen	0.1105	0.043	0.166	0.059
Total saccharides calculated as glucose	7.326	2.313	8.064	2.810

These results support the following conclusions :

1. The analysis of the leaf distinctly shows the characteristics of autumn leaves. The percentage of water is less and the percentage of dry matter is greater than during the spring and summer, as seen from KELLNER'S analyses and results obtained by the writer on the leaves of healthy mulberries at the beginning of June. The greater quantity of substances extracted by ether (fat) is in agreement with the results of SCHULZE and SCHÜTZ concerning the leaves of *Acer Negundo* (Die Stoffwandlungen in den Laubblättern des Baumes insbesondere in ihren Beziehungen zum herbstlichen Blattfall, *Landw. Versuchs-Stationen*, XXI, 313, 1909). In these analyses the ethereal extract of the dry matter was 4.87 per cent one evening during May and reached 10.86 per cent on the evening of September 6. The decrease in total nitrogen, proteid nitrogen and non-proteid nitrogen of the autumn leaves compared with spring and summer leaves is very apparent and agrees entirely with the results of KELLNER'S analysis, as well as with those of SCHULZE and SCHÜTZ.

2. As in the case of other plants, mulberry leaves during the day under the action of sunlight increase their quantity of organic matter, including fats and nitrogenous matter, both proteid and non-proteid, as well as carbohydrates. These results are fully confirmed by those of SCHULZE and SCHÜTZ for the leaves of *Acer Negundo*.

3. Leaves collected at sunset contain more food material than leaves collected in the morning.

It is reasonable to suppose that these differences will be still greater during the spring and summer.

1100 - **Methods of Estimating Carbohydrates. II. The Estimation of Starch in Plant Material (1)** — DAVIS, W. A., and DAISH, A. J. (Rothamsted Experimental Station) in *The Journal of Agricultural Science*, Vol. VI, Part. 2, pp. 152-168. Cambridge, May 1914.

The writers summarise their conclusions as follows :

" 1. The Sachsse method of estimating starch is unreliable in the case of plant material ; not only does the presence of pentosans falsify the results, as pentoses are formed during the hydrolysis, but actual destruction of dextrose occurs during prolonged treatment with dilute acid.

" 2. O' Sullivan's method gives low results owing to the loss of dextrin which occurs during the purification of the solution after the conversion by diastase.

" 3. A method is described for estimating starch based on the use of takadiastase ; under suitable conditions this converts the starch into maltose and dextrose only, and no loss of these sugars occurs when the solution is treated with clearing agents such as basic lead acetate.

" 4. The necessity of removing substances soluble in water, such as gums, etc., which are optically active and thus cause error in the estimation of starch in plant material is emphasised. Special care is also necessary in sampling "

1101 - **The Estimation of Hydrocyanic Acid in Feeding-Stuffs and its Occurrence in Millet and Guinea Corn.** — FURLONG, J. R., in *The Analyst*, Vol. XXXIX, No. 463, pp. 430-432. London, October 1914.

A new method of estimating hydrocyanic acid in feeding-stuffs is described ; it consists essentially in the conversion of hydrocyanic acid into Prussian blue and in the comparison of the resulting coloration with standards ; it avoids the disturbing influence of hydrolytic and distillation

Plant	Stage of growth	Hydrocyanic acid per cent
Guinea corn	6 in. high	0.004
	12 " "	0.01
	18 " "	0.009
	24 " "	0.0025
	8 ft. full grown but unripe	—
	8 ft. full grown and ripe	—
Millet	6 in. high	0.006
	12 " "	0.018
	18 " "	0.022
	24 " "	0.045
	8 ft. 6 in. high	—
	11 ft. 6 " "	—

(1) See also No. 22, B. Jan. 1914.

products which accompany the hydrocyanic acid in the usual iodine or silver nitrate titration methods.

Millet and guinea corn (*Panicum maximum*) plants from Northern Nigeria were recently examined for hydrocyanic acid by the above method. The results are shown in the Table on the opposite page.

All the young plants contained a cyanogenetic glucoside, the amount contained increasing up to a certain point in the life-history of the plant and then diminishing, so that the full-grown plants were free from such bodies. The results indicate the probable course of the development and disappearance of the cyanogenetic glucosides in millet and guinea corn plants, but no general conclusions can be drawn until a larger number of samples have been investigated.

1102 - Some Accessory Factors in Plant Growth and Nutrition. — BOTTOMLEY, W. B. (King's College, London) in *Proceedings of the Royal Society*, Vol. 88, No. B 602, pp. 237-247. London, September 15, 1914.

During the summer of 1913, a number of experiments were made at the Royal Gardens, Kew, (1) on a series of plants to test the manurial value of Sphagnum peat which had been incubated with a mixed culture of aerobic soil organisms for a fortnight at a temperature of 26° C. It had been discovered that by this bacterical treatment the humic acid in the peat is converted into soluble humates, and this bacterised peat, after sterilisation, forms an excellent medium for the growth and distribution of nitrogen fixing organisms. As the experiments progressed it was evident that, in addition to the ordinary plant food constituents, there was present in the bacterised peat a substance which stimulated growth in a remarkable manner. Further experiments showed that this substance was soluble in water, and was effective in very small quantities. It was found that seedlings of *Primula malacoides* potted up in loam, leaf-mould and sand, and treated twice with a water extract of only 0.18 gm. of bacterised peat, were, after six weeks' growth, double the size of similar untreated plants, and it was noted that flower production and root development were promoted equally with increase of foliage.

These results suggested that the growth stimulating action of the bacterised peat might be due to the presence of a substance or substances similar in nature to certain accessory food bodies known to play an important part in animal nutrition. The latter are also known to be soluble in water and alcohol, so the bacterised peat was extracted with absolute alcohol, the extract was evaporated to dryness, and taken up with warm distilled water, portions of 100 cc., containing the extract from 1 gm. of peat, being placed in each of 12 flasks. Six of these were boiled for five minutes and all, including six other flasks, containing only distilled water, received 0.2 gm. of potassium phosphate ($K_2 H Po_4$), 0.02 gm. of magnesium sulphate and 0.2 gm. of calcium carbonate, and were inoculated with 1 cc. of a uniform suspension of *Azotobacter chroococcum*. The contents of two flasks from each of the three series of six were analysed

(1) See also No. 470, B. May 1914.

at once to serve as controls while the remaining four of each series were incubated for eight days at 26° C., at the end of which period they were analysed by the Kjeldhal process for their nitrogen content. The results are given in Table I.

TABLE I.

Series	Nitrogen content		Nitrogen fixation
		mgm.	mgm.
I. Complete food	1 Control . . .	0.4	—
	2 " . . .	0.4	—
	3 Culture . . .	4.6	4.2
	4 " . . .	4.4	4.0
	5 " . . .	3.6	3.2
	6 " . . .	4.4	4.0
II. Complete food + alcoholic extract of bacterised peat	1 Control . . .	2.6	—
	2 " . . .	2.3	—
	3 Culture . . .	20.7	18.2
	4 " . . .	20.5	18.0
	5 " . . .	19.9	17.4
	6 " . . .	20.9	18.4
III. Complete food + boiled alcoholic extract of bacterised peat.	1 Control . . .	2.3	—
	2 " . . .	2.5	—
	3 Culture . . .	19.6	17.2
	4 " . . .	19.0	16.6
	5 " . . .	20.6	18.2
	6 " . . .	19.4	17.0

The results indicate clearly that there is present in the bacterised peat a substance which stimulates plant growth and which is of fairly stable nature, as almost equally good results were obtained with the boiled as with the unboiled extract.

In order to test whether the active substance is present as such in the original peat, or whether it is produced in the bacterised peat as a result of treatment, an extract of the raw peat was made in precisely the same manner as described for the bacterised peat and incubated as before. No increased growth was apparent in the cultures containing alcoholic extract of raw peat.

The active substance being evidently produced in the bacterised peat as a result of treatment, and since this treatment consists essentially in the production of soluble humates by bacterial action, a test was made to ascertain whether the chemical production of soluble humates would be

equally effective. Two equal portions of raw peat were saturated with solutions containing 1 per cent. of their weight of sodium carbonate, and were stirred at frequent intervals for several hours. One portion was allowed to dry slowly at room temperature and an alcoholic extract taken as before; the other portion was leached with water until the washings were colourless, the water extract was then evaporated to dryness and the residue thus obtained extracted with alcohol. The effect of both the alcohol extracts was tested with *Azobacter* and again the cultures failed to reveal any stimulation of the organism.

The accessory bodies concerned in animal nutrition have been shown to be precipitated by phosphotungstic acid; the alcohol extract of the bacterised peat was therefore treated with phosphotungstic acid and a fraction separated which was used in solution in the proportion of 17 parts per million. This fraction was tested upon wheat seedlings: ten seeds were germinated in clean sand in each of nine pots which were arranged in three series of three pots each. Series I was treated with a complete food solution (containing nitrogen, phosphorus and potash estimated as N H_3 , P_2O_5 and K_2O in the proportion of 400, 200 and 1220 parts per million respectively), Series II was treated with complete food plus alcoholic extract from 10 gms. of peat per litre of solution, and Series III with complete food plus phosphotungstic fraction from 10 gms. of peat per litre of solution. Each pot was treated with 100 cc. of its solution one week after sowing the seed and the treatment repeated once a week for five weeks at the end of which period the plants were uprooted, washed, dried and weighed. The results are given in Table II. —

TABLE II.

Series	Weight of 30 plants (green)	Increase over Series I
	gms.	per cent.
I. Complete food	11.94	—
II. » » + alcoholic extract . . .	14.46	21.1
III. » » + phosphotungstic fraction	15.45	29.4

The results indicate that the stimulative substance in bacterised peat is precipitated by phosphotungstic acid and that this phosphotungstic fraction is quite as effective as the original alcoholic extract.

Again working by analogy with the accessory bodies concerned, in animal nutrition a further fractionation was carried out with silver nitrate. The final solution contained 0.35 part per million of the dry silver fraction and was also tested concurrently with the phosphotungstic fraction upon wheat seedlings as before. The results are given in Table III.

TABLE III.

Series	Green weight 45 plants	Increase over Series I	Dry weight at 100° C.	Increase over Series I
	gms.	per cent.	gms.	per cent.
I. Complete food	64.5	—	13.3	—
II. " " + phosphotungstic fraction	96.8	50.0	16.4	22.7
III. " " + silver " "	91.5	49.6	15.7	17.7

The silver fraction having thus given results approaching the phosphotungstic fraction its effect was next tested on wheat seedlings in water culture. At first the growth of the test and control plants was approximately equal, but after the first fortnight the seedlings in the control set seemed unable to utilize the food elements supplied to them while those in the silver fraction series went on growing up to the end of the experiment (50 days).

It has previously been shown that seeds of barley, oats, peas and flax fed to guinea pigs, contained no accessory bodies having a curative effect on scurvy, but that these were developed during germination. These facts indicating the possibility of the development during germination of special growth substances which enable the embryo to utilize the food material present in the seed, a further series of water cultures was carried out in which the wheat seedlings were carefully separated from their seeds as soon as possible after germination. The difference in growth between the control and silver fraction set was even more marked than in the previous experiment as the control set never increased more than 5 per cent. of its original weight, while at the end of the experiment the silver fraction set had increased 59 per cent. of its original weight.

It would therefore appear that during the germination of wheat seeds certain substances are formed which enable the young embryo to utilize the food material's present. The supply of these substances formed by the seed during germination is sufficient to establish the embryo as an independent seedling, then some other source is necessary. It has been shown that these accessory food substances are produced when peat (decayed vegetable matter) is acted upon by certain soil bacteria, and the natural inference is that during the bacterial decomposition of organic matter in the soil, that is during humus formation, these substances are formed, hence the beneficial effect of farmyard and other organic manures. The specific action of these accessory substances is not known and experiments are in progress to test various hypothesis in this connection.

susceptibility and immunity to attacks of *Puccinia glumearum*. The material, however, displayed so much diversity in the density of the ears that it was ultimately used only for investigating the mode of inheritance of this character.

With regard to preceding investigations, it should be noted that SPILLMAN, STRAMPELLI and v. RÜMKE all get an F_1 of intermediate character, and an F_2 of 1 dense : 2 intermediate : 1 lax ; while WILSON and TSCHERMAK find dense to be distinctly dominant in F_1 , and the former got a ratio of 3 dense : 1 lax in F_2 . NILSSON-EHLE and BIFFEN obtained different results from different crosses.

In the present investigation, two crosses were utilized : American Club \times Square White and American Club \times Square Ghurka.

American Club is a typical *compactum* wheat, while Square White and Square Ghurka are both *vulgaris* wheats of hybrid origin which had bred true to type for a series of years.

In *compactum* wheats the average space between the spikelets of the ear in millimeters, or the density, is 2.1 or 2.2 while in *polonicum*, which is typical of the lax ear, it is 6.6. Between these two extremes there is an almost unbroken series among the *vulgaris* wheats: the internode length of Square Ghurka varies from 3.9 to 5.1 and that of Square White is practically the same; they would thus both be considered lax by NILSSON-EHLE, whereas American Club is a typical *compactum* with internode length from 1.9 to 2.5.

The F_1 generation of American Club \times Square Ghurka was apparently almost intermediate, but the tendency was toward the dense parent.

F_2 showed, besides all intermediate forms, a large number of plants the ears of which were either more lax or more dense than the ears of either parent. Their curve, though continuous, gives evidence that segregation is taking place. Offspring was grown from each plant of F_2 ; in F_3 nearly all of the lax-eared plants bred true to laxness and a certain proportion of the dense-eared plants bred true to denseness, but it was practically impossible to see which plants bred true to their particular degree of denseness or laxness. It is particularly noticeable that although a large proportion of the very dense-eared plants threw no lax, there were several which were heterozygous, and that the curves which the F_3 series form have shifted toward the high, or lax, side.

Similar results were obtained in the F_2 and F_3 of the Square White \times American Club cross.

From the Square Ghurka American Club cross, 36 F_3 plants were grown on, being chiefly selected either because they lay between the two peaks of the curve or because they lay at the extremes of the curve. In the curve for the partial F_4 (1913), the peaks revert almost exactly to the position which they held in 1911, and this seems to suggest that some such factor as the wetness of the summer of 1912 was responsible for the shift shown in the curves for that year.

A fact which is noticeable in the descendants of the F_2 and F_3 plants is that in the non-splitting dense and lax, especially in the former, there seems to be a distinct correlation between the degree of density of the parent and the average degree of density of the offspring. There can only be two possible theories to explain this phenomenon. It may be due to nutrition, admitting that the grain of the very compact ears is lighter than that from ordinary ears, that weak plants develop from small grain and that the ears of weak plants are appreciably more dense than those of normal plants. But this theory is not very probable (see the works of JOHANSEN and others). It seems safe therefore to conclude that the alternative theory is the true one, namely, that underlying the main 3:1 ratio, there are other factors which have a modifying effect on the laxness or denseness of the ear. This is probably also the explanation of the appearance of plants which exceed the limits of either parent.

From the comparison of the number of nodes and the rachis length of the ears of lax, dense and Squareheads Master wheat of 1912 (wet year) and of 1913 (relatively dry), it appears that the first number in 1913 was greater respectively by 33, 39 and 10 per cent, and the second was respectively greater by 15 and 21 per cent and smaller (Squareheads Master) by 2 per cent. Consequently, the larger variation is a meristic variation, and external conditions would seem to cause an alteration of nearly 40 per cent in the number of parts. As the nodes are already completely formed in young wheat plants, the conditions which control this variation can only be operative during the early life of the plant, while those which control the length of the rachis act during the whole growing-period of the plant. Thus weather experienced after the earlier period of growth might nullify the effect caused by the weather of that time, and then the variation of the two characters would become practically independent.

From the above it will be seen that the actual method of classifying wheats according to the density of their ears is unreliable, as the number of internodes and the total rachis length vary largely from season to season and it might be possible to get a variability of well over 50 per cent in a variety from one year to another, and that even when grown on the same soil with identical manurial and cultural conditions.

1104 — On the Emasculation of Giant Maize in Serbia. — HECKEL, EDOUARD, in *Comptes Rendus hebdomadaires des séances de l'Académie des Sciences*, Vol. 159, No. 16, pp. 595-597. Paris, October 1914.

Previous work (1) by the writer has shown that the giant maize of Serbia (13 feet in length of stems and 8 inches in length of ear), which normally contains about 9 per cent of saccharine matter in its sap at the beginning of September, has its sugar content increased to a maximum of 12 per cent by partial removal of the male flowers and to 11.57 per cent by removal of the female flowers. After the end of September the amount of sugar rapidly diminishes and at the period of harvest it is less than half.

Later experiments with plants grown close together under identical

(1) See No. 1618, B. Dec. 1912.

(Ed.)

conditions have shown that the effect of emasculation on the sugar content of the sap is very variable and may even be negative. With the formation of a reserve of sugar there is also a formation of starch reserves, except when the sugar content remains low after removal of the male flowers or when the flowers are left intact.

The writer proposes to increase and to fix the sugar content by means of selection. Partial emasculation does not affect the yield of grain and is easy to carry out; it also provides a good winter forage much liked by stock.

1105 - **Alfalfa Hybridization.** — SOUTHWORTH, WILLIAM (Department of Plant Breeding, Ontario Agricultural College, Guelph, Canada) in *The Journal of Heredity*, Vol. V, No. 10, pp. 448-457 + 3 figs. Washington, October 1914.

Notwithstanding the immense economic value of the present day strains of alfalfa grown in the United States they may still be improved on at least two lines:

1. To obtain a strain having the capacity to seed more freely under various environmental conditions.

2. To obtain a variety which will be better adapted for grazing.

The first part of the problem might be solved by simple selection; unfortunately all the types which offer possibilities for grazing appear to be below the average in the production of seed. The writer therefore endeavoured to solve the problem by crossing with black medick (*Medicago lupulina* L.), which yields good grazing but not good hay. In the United States it is looked upon as a weed.

At the Ontario Agricultural College at Guelph experiments were commenced with the aim of breeding better strains of alfalfa. It was found necessary to arrange a preliminary series of experiments in order to elucidate the complex and still unsettled problem of the pollination of its flowers. The results obtained showed: 1) that alfalfa flowers are incapable of becoming fertilized when insects do not gain access to the flowers (1); 2) that if the stamens and pistil be liberated artificially the flower is capable of producing seeds; hence it is not self-sterile; 3) that bees are the most numerous visitants, but they have the power to extract the nectar from the flower without causing pollination; the bumble bee is fairly active in fertilizing the flowers; a species of *Andrena* is apparently very useful, too; but the most effective of all was found to be a wild bee belonging to the *Megachile* group, as it will pollinate from eight to twelve flowers a minute.

DARWIN and BURKHILL had observed, and the writer has confirmed their observation, that the flowers of *Medicago lupulina* are autogamous and produce seed even without the aid of insects. Burkhill found that where these flowers were left exposed to the visits of insects 95 per cent. produced seed; when enclosed in a net 75 per cent. set seed. In practice

(1) The results obtained by PIPER and his collaborators show that in sufficiently good conditions of temperature and dryness of the atmosphere, alfalfa produces seed spontaneously also (by automatic pollination) without the assistance of insects. See No. 894, *B.* Oct. 1914. (Ed.).

M. lupulina produces abundant seed under any condition of climate and soil.

The writer commenced the work in 1911. The F_1 generation (24 plants) showed considerable variations, even among individuals produced from different seeds out of the same pod, and for the most part the plants differed considerably from both parents. Their height ranged from 7 to 23 inches; the stem in some was thin and flexible, in others rigid, and the leaves varied from few and small to many and densely crowded.

The second generation was obtained from a plant distinguished for its vigour and abundance of flowers and seeds. The plants composing it showed all the degrees between Talls and Dwarfs, ranging in height from 2 to 11 inches, 78 plants being above the height considered as medium, namely 5.5 inches, and 30 below it, which would give the ratio of Talls to Dwarfs as 2.6 to 1 instead of the calculated Mendelian ratio of 3:1. As for the habit of growth, 88 plants were non-erect (3 prostrate and 85 decumbent) and 20 erect (12 semi-erect and 8 erect), which gives the ratio 4.4 non-erect to 1 erect, instead of 3:1.

The experiments are being continued. In the course of these tests the writer observed that those seeds which remained hard and dormant after having been for several days in the germinator at 70° F., sprouted in one or two days, when replaced in the germinator after immersion for 10 minutes in strong commercial sulphuric acid and subsequent washing free from acid. The few seeds which resisted this treatment were treated to a second immersion in sulphuric acid, after which they sprouted.

AGRICULTURAL
SEEDS

1106 — *Tree Growth and Seed.* — BERRY, JAMES B. (Department of Forestry, Pennsylvania School of Agriculture, State College, Pa) in *The Journal of Heredity*, Vol. V, No. 10, pp. 431-434 + 2 figs. Washington, October, 1914.

Dr. ARNOLD ENGLER (1), at the Forest Experiment Station of Zürich, has a number of investigations in course, which illustrate the inheritance by seedlings of the main characteristics of the parent tree. In one of these experiments two plots are occupied by spruce seedlings varying in height from 3 to 10 feet. The seedlings on Plot I show more than 50 per cent. crooked and twisted plants, while Plot II contains less than 5 per cent. of this material. The seed used on Plot I was collected from a gnarled and twisted mother tree, yet not an extreme form. The seed used in Plot II was taken from a mother tree of normal form grown under the same conditions as the deformed one.

A second experiment occupies two adjacent plots, both supporting a growth of spruce seedlings about 15 years of age planted at the same distances from each other. The seedlings on Plot I, while entirely healthy and vigorous, are rounded in form, very dense in character and with branches uniformly small; their height ranges from 12 to 30 inches and they are as broad as they are high. The seedlings on Plot II are entirely normal in form and growth; they are between 3 and 6 ft. in height. The seeds of Plot I were taken from a mother tree which was characterized by density of

(1) Influence of Source of Seed. — *Journal of Heredity*, Vol. V, No. 4, p. 185, April 1914.

branching and slow growth, while, those of Plot II were from a normal mother tree grown on the same quality site and under similar conditions.

A third investigation deals with the effect of temperature in its relation to transmitted characteristics. Seed was collected from regions of mean temperature varying by 10° F, from that of Zürich to Northern Sweden, altitude and latitude both forming a basis for computation. Two or three rows were planted from each lot of seed, the arrangement being in regular order from the lowest to the highest mean temperature. At present, eight years after the inauguration of the experiment, there results a "terrace" like formation, the relative height growth varying directly with the mean temperature. Further, the plants resulting from seed from a locality of high mean temperature are the first to show active growth in the spring and, having a longer growing season, their annual increment is greater and their form is less dense. It is thus very important for the forester to know the origin of the seeds and the quality of the mother plants.

These facts may afford an explanation for some of the unsatisfactory results in forestry. For instance it is said that Scots Pine (*Pinus sylvestris*) gives very poor results in the United States and that it is not adapted to that country. The writer suggests that better results might be obtained by choosing the seed better.

The seedling resulting from seed from a region of higher mean temperature than that of the locality in which it is to grow will preserve its original slim bearing and the long willowy previous year's growth is easily crippled or broken by the weight of the snow. The seed should be chosen from localities having an average altitude and temperature similar to that of the place where it is to be sown, and lastly when regeneration of the forest is to be obtained by spontaneous seeding, the best plants should be left for this purpose and not the deformed and the cripples, as is too frequently done at present.

1107 — **The Controlling Influence of Carbon Dioxide in the Maturation, Dormancy and Germination of Seeds.** — KIDD, FRANKLIN (Fellow of St John's College, Cambridge) in *Proceedings of the Royal Society, Series B*, Vol. 87, N s B. 597 and 599, Biological Sciences, pp. 408-422 and 609-625. London, June 1914.

The object of this research is to solve the problem of the non-germinating of maturing seeds while still upon the parent plant and the large number cases of delayed germination or non-germination of shed seeds which to all appearances are in good condition for germinating.

The dormancy of moist seeds must be due either to the absence of an essential stimulus or to the presence of an inhibitory agent. CROCKER found that *Xanthium* seeds would not germinate at a temperature of 19° C. though provided with a sufficient supply of water and a normal atmosphere with a partial pressure of oxygen equal to 150 mm. On removal of the testa, however, germination immediately took place. SHULL found that these seeds will germinate at a temperature of 21° C. with a minimal oxygen pressure of 12 mm. when the seed coat is removed, thus showing that the wet testa is able to reduce the partial pressure of oxygen in its passage through it, from 150 mm. pressure to less than 12 mm.

It is possible that the absence of germination during the maturation of the seed and later during its normal resting period may be due not only to an insufficient oxygen stimulus but also to some inhibitory cause, such as a relative rise in the actual carbon dioxide pressure in the embryo tissues.

Experiments were conducted with various seeds in atmospheres with various partial pressures of carbon dioxide. It was found that increases in carbon dioxide pressure retarded germination and that this retardation was not accompanied by injury. The seeds used in these experiments fell into two classes: 1) those which germinated at once after removal from the inhibitory doses of carbon dioxide (beans, cabbage, barley, peas, onions); 2) those in which the retardation continued indefinitely after removal from the carbon dioxide (*Brassica alba*) and was terminated only by complete drying and re-wetting, or by the removal of the testa.

This suggests that carbon dioxide lowers the degree of permeability of the testa in the second class of seeds, thus causing a reduction in the amount of oxygen reaching the embryo and a relative rise in the actual carbon dioxide pressure in the embryo tissues. The condition of prolonged inhibition after removal to air produced in *Brassica alba* is strikingly suggestive of the condition of seeds often met with in nature, the germination of which is delayed in spite of suitable conditions of temperature and water. Similar results were obtained with *Brassica alba* seeds in the soil under natural conditions by carbon dioxide arising from decaying vegetable matter. The high carbon dioxide content of the soil was found to continue for a considerable period (7 months). *It would therefore appear that caution is necessary in sowing seed in ground in which green crops or dung has been recently ploughed in.*

A further series of experiments was carried out to determine the relation of the retarding effect of carbon dioxide to temperature and oxygen supply. It was found that low temperatures and low oxygen supply both increased the inhibitory effect of given partial pressures of carbon dioxide and inversely a rise of temperature or rise of the partial pressure of oxygen diminished the inhibitory value of the given carbon dioxide pressure.

The growth of the embryo of a seed proceeds continuously after fertilisation and up to a certain point resembles in some respects the subsequent growth on germination. Beyond this stage partial inhibition begins and increases in the case of most seeds until, at the stage of complete maturation, growth is arrested or suspended. Experiments were conducted to ascertain the nature of this inhibiting factor. It was found that removal of the testa in the case of peas greatly increased the rate of germination, and that beans, germinated after complete air drying in the laboratory, at the moment of sprouting actually contain less water than when originally removed from the fresh green pods. It would appear therefore that neither lack of water nor any physiological insufficiency can be regarded as the factor limiting germination.

The carbon dioxide content of maturing and germinating seeds was then determined by grinding with baryta and titration with hydrochloric

acid. It was found that the carbon dioxide content of maturing seeds was considerably greater than that of germinating seeds in the case of peas and beans.

In the case of seeds with a low carbon dioxide content, the writer confirmed the conclusions of DRABBLE and LAKE that small quantities of carbon dioxide have a stimulating effect on germination. It would appear therefore that the effect of larger percentages of carbon dioxide is that of a true narcotic and that the *results induced by carbon dioxide in the resting seed are a phase of narcosis*.

In the case of rapidly deteriorating seeds, such as those of *Hevea brasiliensis*, the carbon dioxide naturally produced by respiration in a closed flask rose to 40 per cent, and the presence of this was found to be accompanied by a marked prolongation of the vitality of the seeds.

The biological importance of the dormancy of moist seeds in relation to the struggle for existence and in evolution is also pointed out.

1108 - Studies upon Influences affecting the Protein Content of Wheat (1). — SHAW, G. W., in *University of California Publications in Agricultural Sciences*, Vol. 1, No 5, pp. 63-126. Berkeley, Cal. October, 1913.

CEREAL AND
PULSE CROPS

In 1905 the Merchants' Exchange of San Francisco, the State Board of Trade, the Sacramento Valley Development Association, and the more prominent millers and grain dealers of California, called the attention of the Agricultural Department of the University to the low gluten content of the local grown wheat, which necessitated the importation of many hundred tons of wheat per year to maintain the quality of Californian flour.

In 1906 the Department of Agriculture initiated these researches to investigate: 1) the effect of changes of environment upon the growth of cereals, particularly as regards the composition of the wheat kernel and with special reference to the causes of the production of a low protein content; 2) to discover or produce such wheat as will yield the largest profit per acre for the farmer, and will supply the millers with wheat of superior quality; 3) to conduct similar experiments with oats, barley, and other cereals as may be desirable; 4) to determine the effectiveness of various methods of culture as affecting the production of cereals.

This publication contains a very detailed account of the results of researches on the variation in the protein content of wheat grown under different conditions as regards: 1) latitude, 2) season, 3) time of planting, 4) time of harvesting, 5) amount of sunshine, 6) irrigation, 7) reduction of night temperatures and 8) the different fertilizers.

Summarising the results of this work carried out over a period of six years the writer draws the following conclusions:

1. There are important seasonal, varietal, and individual variations in wheat plants with respect to protein content.

2. The chief factor causing the most pronounced variation in protein content is climate, particularly the moisture supply in the final stages of

(1) See also No. 228, B. March 1913 and No. 331, B. April 1914.

(Ed.).

growth. Wheat grown in the coast States is, as a class, much lower in gluten content than wheat grown in the central-west or the northwestern States.

3. The tendency of wheat kernels to change from a glutenous to a starchy condition is not constant, but is mainly dependent upon the individuality of the plant and seasonal influences, particularly moisture supply in later stages of growth. The use of a perfectly typical glutenous seed is invariably followed under Californian conditions by a lowering of the gluten content, as indicated both by the physical appearance of the grain and by its protein content.

4. In wheats all of which are entirely starchy there may be a reversion to an entirely glutenous condition in a single season, or the reverse may occur, according to the seasonal condition.

5. Allowing the grain to stand on the straw in the field until fully ripe does not materially affect the protein content.

6. The protein content of wheat is affected by the time of seeding, the product of late-seeded grain having a higher percentage of protein than that of early-seeded grain.

7. The protein content of wheat is very largely influenced by the water content of the soil in the later period of its growth, and the effect of either irrigation or rainfall during this period is to lower its protein content.

8. The percentage of sunshine which the grain receives during its period of growth has a somewhat direct bearing upon its protein content, but other seasonal conditions are more important.

9. Retarding the growth through cooling the atmosphere has a tendency to increase the protein content.

10. The quantity of available nitrogen beyond that required to supply normal growth has little, if any, influence upon the protein content.

11. The low gluten content of Californian wheats is not due to soil exhaustion, but rather to the following causes: *a*) the long growing period, *b*) relatively early seeding, *c*) the use of varieties of naturally low gluten content, and *d*) the absence of selection of highly glutenous seed.

1109. — **The Variation of Gluten in Wheat Flour and Grain.** — MARCHADIER and GOUJON (Director and Chemist of the «Laboratoire municipal agréé du Mans»), in *Journal de Pharmacie et de Chimie*, Year 106, Series 7, Vol. XI, pp. 191-202. Paris, September 1914.

According to BAILLAND (1), the decrease in gluten in flour observed of late years, that is to say since roller-mills have been substituted for grindstones, is due not only to a degeneration of the grain, but also to methods of grinding which eliminate the germ and the portions of the grain which are richest in nitrogen, to more complete sifting and to the hydration caused by excessive moistening with a view to facilitating the removal of the pericarp.

(1) See No. 778, B. Aug. 1914.

(Ed.).

According to VUAFLART, the decrease is to be attributed to atmospheric variation. SCHRIBAUX observes that in 1911 (a hot year) the grain was much richer in gluten than in 1912 (a rainy year) and that glutinous varieties grown near Paris had a lower gluten content. On the other hand the gluten content increases in the case of wheat grown on almost virgin soil, without any fertilizer, in the plains of America.

Gluten is a characteristic of wheat flour. It is stated that gliadin and glutenin (which is an oxidised anhydride of the first) are wholly, or partially, transformable into one another. FLEURENT has shown that a flour produces a softer dough and more digestible bread, the nearer the composition of the gluten approaches to 75 per cent gliadin and 25 per cent glutenin. A deviation of only 2 per cent from this proportion is sufficient to cause a noticeable difference in the bread.

It has been observed that the addition to wheat flour of only a small quantity of other flours causes a great change in the gluten, and a decrease in the amount which is capable of coagulating. When the amount of the other flour introduced passes beyond certain limits, the gluten no longer coagulates at all. Thus its power of coagulation disappears on the addition of 40 per cent of rye flour (COLLIN), 40 per cent of barley meal, 65 per cent of rice flour, 70 per cent of maize flour. These facts have been proved by experiments made by the writers.

The coagulation of gluten is also prevented or hindered by the addition of powdered minerals, and by wheat starch, which suggests that the result is due simply to physical causes.

If the amount of gliadin be diminished, the quantity of gluten decreases in a parallel manner, and since the smallest variation in the proportion of gliadin to glutenin is sufficient to cause very sensible changes in the bread-making quality of the gluten, in the same way a variation in the total of gliadin + glutenin in the paste brings about very rapidly: first the occlusion of a part of this gluten, and finally the complete loss of its power of coagulation.

As has been said, this abnormal decrease in the coagulable gluten has also been noted in the wheat grain. Further, it has been recorded, that gliadin and glutenin are easily transformed into one another, the slightest influence being sufficient to bring about the change. In germination, the ferments which produce solubility hydrate the glutenin, transforming it into gliadin: the proportion $\frac{\text{glutenin}}{\text{gliadin}} = \frac{1}{3}$ is altered, whence the flour gives a lax dough and the bread made from it rapidly hardens and is indigestible.

By too rapid grinding, the grain becomes heated, this giving rise to the dehydration and oxidation of the gliadin to form glutenin.

Keeping damp flour in a warm place in the presence of dry air causes slight oxidation and dehydration of the gliadin and improvement of the product. If, on the other hand, a good flour is kept in a damp warm atmosphere, the glutenin becomes hydrated and is transformed into gliadin and the product deteriorates. Such hydration may also be the effect of

meteoric influence: in fact the wheat of wet seasons always yields inferior flour.

It is well known that when the acidity of flour is above 0.050 per cent, the coagulation of the gluten is hindered and its elasticity either lessened or lost. An increase of 0.025 per cent in acidity corresponds to a decrease of 10 per cent in the damp gluten *i. e.*, of a little more than 3 per cent in the dry gluten.

It is logical to admit a similar effect of acidity upon the grain also, and it cannot be denied that acids influence the formation of gluten.

Nowadays, and especially during the last twenty years, the soils under wheat in Europe have been dressed with superphosphates, which carry into the soil their acid reaction.

This super-acidity due to strong acids (sulphuric chiefly and hydrofluoric in some cases) must have some effect upon the elaboration of gluten in the grain. In fact species of wheat rich in gluten become softer when cultivated in Beauce and Brie, districts which are highly cultivated and much manured with superphosphates, while the gluten is preserved in wheat grown on the unmanured soils of America.

There are no data at hand to show that the acidity of grain has diminished during the last twenty years, but according to the writers three facts speak in favour of their hypothesis:

1) On adding rye flour to wheat flour, while the gluten diminishes the acidity increases.

2) Rye flour, which contains no gluten, possesses an acidity ten times greater than that of wheat flour.

3) Acetic acid oxidises and dehydrates gliadin, and when a wheat flour with the proportion $\frac{\text{glutenin}}{\text{gliadin}} = \frac{1}{3}$ is treated with this acid, a gluten is obtained by evaporation, in which this proportion is equal to one.

In conclusion, the diminution of gluten in native wheats is principally due to the effect of acidity.

1110 — **Experiments with Autumn Sown Crops in Ontario, in 1911.** — ZAVITZ, C. A., in *The Agricultural Gazette of Canada*, Vol. I, No. 9, pp. 740-742. Ottawa, Canada, September 1914.

Winter wheats. — About 280 varieties of winter wheat and a large number of selections and crosses have been grown under experiment at the Ontario Agricultural College at Guelph, during the past twenty-five years. Nearly all the varieties have been carefully tested in each of five years, after which the inferior kinds have been discarded and those which have given the best results have been continued in the experiments. Of the named varieties, the fourteen given in Table I were grown for nineteen years. The average yields during this period are shown in the Table. The lowest average yields in the nineteen years were 20.2 bushels in 1912; 28.3 bu. in 1895; 32 bu. in 1908; 34.1 bu. in 1904; and the highest yields have been as follows: 66.7 bushels in 1900; 61.6 bu. in 1902; and 60.5 bu. in 1903. In 1899 and 1901 the results were so poor that no satisfactory returns could be made.

TABLE I. — *Yield per acre of winter wheat, average of 19 years.*

Variety	Tons straw	Bushels grain
Dawson's Golden Chaff	2.9	51.1
Imperial Amber	3.2	48.1
Early Genesee Giant	3.0	46.5
Egyptian Amber	3.2	46.4
Early Red Clawson	2.8	46.1
Rudy	2.7	45.0
Tasmania Red	2.9	44.4
Geneva	3.0	43.9
Tuscan Island	2.9	43.3
Kentucky Giant	2.8	43.2
Turkey Red	2.7	43.0
Treadwell	2.8	41.7
Bulgarian	2.8	41.5
McPherson	2.6	41.5

The varieties of wheat which produced the largest loaves from equal quantities of flour, as it appears from careful tests for bread production carried out at the Bakery Branch of the Chemical Department at the Guelph Agricultural College, were as follows: Banatka, Crimean Red, Yaroslav, Tuscan Island, Tasmania Red, Egyptian Amber, Buda Peth, Rudy, Treadwell, McPherson and Bulgarian.

In 1913 the Agricultural College distributed five varieties of winter wheat to a great number of farmers who wished to test them in various parts of Ontario. The average yields per acre are given in Table II. It will be seen that Imperial Amber, which occupies the second place in the average of the College experiments, is classed first in the cooperative experiments with farmers. Crimean Red, although a rather weak-strawed variety, is a good yielder and produces grain of excellent quality.

TABLE II. — *Average yield per acre of winter wheat in 1913-14, in various parts of Ontario.*

Variety	Tons straw	Bushels grain
Imperial Amber	1.63	31.7
American Banner	1.40	30.8
Crimean Red	1.34	30.4
Banatka	1.28	28.8
Yaroslav	1.57	28.3

In the cooperative experiments with the farmers, different fertilizers were applied in the autumn to winter wheat: the average yields of grain per acre for eight years were as follows:

	bu. ---
Farmyard manure: 20 tons per acre	25.8
Mixed fertilizer: nitrate of soda 53 lb., chloride of potash 53 lb. and superphosphate 107 lb. per acre.	23.5
Nitrate of soda: 160 lb. per acre	22.5
Chloride of potash: 160 lb. per acre	21.5
Superphosphate: 320 lb. per acre	21.2
Without manure	18.1

Winter rye. — In each of the past eleven years four varieties of winter rye have been under experiment at the College. The following average results in yield of grain and in weight per bushel have been obtained.

	Bu. per acre —	Bushel weight lbs.
Mainmoth White	58.3	57.5
Washington	55.2	57.6
Common	53.2	57.0
Thousand Fold	53.0	57.4

1111 - On the Botanical Origin of Cultivated Rices. — CHEVALIER, AUG., and ROEHRICH, OLIVIER, in *Comptes Rendus hebdomadaires des Séances de l'Académie des Sciences* Vol. 159, No. 14, pp. 560-562. Paris, October 5, 1914.

The extensive geographical distribution of cultivated rice and the antiquity of its cultivation have prevented botanists from determining whether the numerous varieties are derived from one common type or from several, as well as from discovering precisely in which country they originated.

The wild rices of Asia, except one found in Indochina by one of the writers, are distinct from the cultivated varieties. This exception shows no specific differences from cultivated rices and is probably the original species from which all the varieties of the species *Oryza sativa* have been derived.

Four wild species distinct from *O. sativa* have been found in Africa. Nevertheless one of them appears to belong, if not to the original type, at least to a type very similar to some varieties cultivated exclusively in West Africa, and which is often found amongst the crops of the typical rice introduced from the Middle East by the Portuguese some centuries ago.

The five principal species studied by the writers are as follows:

1) *O. latifolia* Desv. = *O. punctata* Kotschy. The species *O. punctata* of the Egyptian Soudan is identical with *O. latifolia* of India and M. Chevalier found that it occurs also in Dahomey.

2) *O. breviligulata* A. Chev. et Roehrich. = *O. Barthii* A. Chev. *pro parte*: occurs wild in the regions of the Soudan (French Nigeria) inundated

(1) See also, No. 802 B. March 1911.

(Ed.).

by the Niger and in the swamps of Baguirmi. A certain number of wild rices of Central and Western Africa are related to this species, and only differ from it in a few characters. Some of the cultivated rices of West Africa are also related to this species. *O. glaberrima* Stend. is a variety of these cultivated rices, of which some show also a second variation of long glumes.

3) *O. brachyantha* A. Chev. et Roehrich. = *O. Barthii* A. Chev. *pro parte*: in the Western Soudan and Egyptian Soudan.

4) *O. longistaminata* A. Chev. et Roehrich. = *O. Barthii* A. Chev. *pro parte*. Perennial rice with rhizomes, largely distributed throughout tropical Africa (Senegal). It is the perennial rice of Richard-Toll found by AMMANN (1). It is found growing with other wild rices in Nigeria, Baguirmi, Chari, Egyptian Soudan, Tanganyika, and the Belgian Congo.

5) *O. sativa* L. (*sensu lato*). Occurs wild in Annam, Cochinchina and Cambodia, on lands flooded during the rainy season and in rice fields which remain wet after the harvesting of cultivated rices. It is considered as a weed by the natives.

III2 - Accumulated Fertility in Grass Land in Consequence of Phosphatic Manuring,
— SOMERVILLE, W. in *The Journal of the Board of Agriculture*, Vol. XXI, No. 6.
pp. 481-492 + 1 pl. London September 1914.

During the past 20 to 30 years extensive areas of grass land have been treated with phosphatic manures, notably basic slag, and in most cases, with large profit.

The initial cost of the manure, about £1 per acre, is, in the great majority of cases, recovered with interest in the first 3 or 4 years by the greater production of grass, so that the accumulated nitrogen and humus is practically gratuitous.

The experiments carried out by the writer at Oxford were calculated to determine to what extent the soil is enriched by the phosphatic manures applied to grass land. Samples of soil were taken from five farms which included grass fields, part of each of which had been treated with basic slag in previous years, while part had been left untreated. Two sets of flower pots were filled with the soil from each centre, five with the treated and five with the untreated soil. The experiments with the soil of one farm had to be abandoned, so the results apply to four localities only. Each pot contained the same weight of dry soil, about 3 lbs., and was sown with Black Bell oats which were thinned down to seven plants in each pot. The five pots filled with soil from the manured part and the five from the unmanured portion of the grass land from each locality were treated as follows: Nos. 1 and 2 did not receive any direct manuring for the oats; No. 3 was given 1 gram of basic slag, equivalent to a dressing of 15 cwt. per acre; No. 4, 0.5 gram of rape meal, equal to about 7.5 cwt. per acre; and No. 5, 0.5 gram of rape meal and 1 gram of basic slag. When the plants were mature they were harvested and yielded the following results:

FORAGE
CROPS.
MEADOWS
AND PASTURES

(1) See also, No. 802 B, March 1911.

(Ed.)

	Total weight of plants — grams	Total weight of seeds — grams
<i>Unmanured oats :</i>		
8 pots of untreated soil	82	22.980
8 " " treated "	136	34.140
<i>Oats manured with slag :</i>		
4 pots of untreated soil	56	14.600
4 " " treated "	81	17.260
<i>Oats manured with rape meal :</i>		
4 pots of untreated soil	41	11.055
4 " " treated "	60	17.605
<i>Oats manured with rape meal and slag :</i>		
4 pots of untreated soil	46	14.110
4 " " treated "	67	19.735

Thus even the abundant manuring with rape meal and slag yielded a crop inferior to that due to the accumulated fertility in the grass land that had received phosphatic manure.

The experiment is being continued ; the same pots were sown with white mustard ; at the end of August its appearance showed evidently that a single crop had not exhausted the accumulated fertility in the soil.

The writer summarises the results as follows :

1. Phosphate manures, besides having a direct beneficial effect on grass land, are advantageous to the tillage crop grown on the broken-up pasture, which is likely to be improved by 50 per cent.

2. Naturally, such improvement will vary with circumstances. In the above experiments the productive power of a soil that had been dressed three times with 10 cwt. of basic slag per acre during 17 years was increased 153 per cent ; while another soil that had received 7 cwt. of basic slag only three years previously was improved by 124 per cent. The other two soils showed improvement of 31 and 15 per cent.

In those districts where the soil and climatic conditions are favourable to the growth of cotton, farmers in South Africa will find that it will prove a remunerative crop for their non-irrigable lands. This has been demonstrated by experiments conducted by the Rustenburg Experiment Station of the Tobacco and Cotton Division of the Department of Agriculture, where eight varieties of cotton gave yields of more than 1100 lbs. of seed cotton per acre. Of these, three gave more than 1400 lbs. and one variety went as high as 1684 lbs. of seed cotton per acre. Each of these varieties gave yields of more than 400 lbs. of lint and two gave more than 520 lbs. per acre.

In the Cape Province most gratifying results have been obtained. Of six varieties tested in Pondoland in 1911, five gave yields of more than 1000 lbs. of seed cotton per acre, and one variety as much as 2067 $\frac{1}{2}$ lbs. of seed cotton per acre.

Experiments are just being established in Natal, but from previous results it may be said that cotton is a crop eminently suited to a large part of that Province. On the British market practically every consignment of South African cotton has realized higher prices than American cotton of similar types.

The soils which give the best results are sandy and clay loams and alluvial soils. Considering the irregularity of the climate in South Africa, the crop is not so certain on light sandy soils, on stiff clays and on turf soils, in the latter of which cotton germinates badly during dry seasons. Since cotton is planted in October or November, it is necessary that the rainfall during these months and December be sufficient, or else a full yield will not be obtained; these three months may therefore be considered the critical period of cotton cultivation in South Africa.

Among the staple crops grown in South Africa, cotton is the least exhaustive of soil fertility, as may be seen from the accompanying table, which gives the amounts of plant food removed from the soil by various crops.

Crop	Nitrogen	Phosphates	Potash
	lbs. per acre	lbs. per acre	lbs. per acre
Cotton	21.36	10.97	9.21
Maize	73.74	23.96	63.06
Wheat	33.32	10.20	16.82
Tobacco	56.00	7.00	69.00

At the present time this Division is not in possession of sufficient data from all sections of the Union to be able to advise what varieties to grow in each of the several districts. From the results already obtained, it can be stated that for the greater part of the Transvaal the varieties of the big-boll group, including Cleveland, Christopher, Russell's, Pullnot, Bancroft and Bohemian, give the best results. In some parts of the Transvaal, where the soil is very fertile and the growing season long, the best results are obtained from Cook's Long Staple. This applies to the vicinity of Tzancan and the Brak River Valley. Along the coastal belt the best returns have been secured from the varieties of the long staple group, which includes Cook's Long Staple, Nyassaland, Griffins, Sunflower and Allen's.

All the above varieties are annuals. The results obtained with the perennials have not, as yet, been sufficiently satisfactory to recommend their cultivation.

1114. — *Urena lobata* in its Wild State in Madagascar. — DROUHARD, E., in *Colonie de Madagascar et Dépendances, Bulletin économique*, Year 14, Part 2, No. 2, pp. 142-145. Antananarivo, 1914.

This plant occurs in a wild state in Madagascar, but it is not used by the natives as a textile plant. They occasionally use it in the manu-

facture of their of ropes, but they do not cultivate it; on the contrary they destroy it by setting it on fire when it is dry, but the seeds retain their vitality owing to their thick shell.

It grows in a wild state in the State of São Paulo, Brazil, and is cultivated with success in the neighbourhood of Campinas, whilst the fibres are worked in a spinning mill and weaving shed at São Paulo.

The plant is cut at the end of the flowering season and retting is carried out by the ordinary process of immersion of the fresh or dried stems in water. The water should be clear and running with a strong current. Retting lasts from 5 to 15 days or more according to the age and thickness of the stems, the best fibre being obtained from the thinnest stems.

The process of decorticating is very simple and it is easier when the stalks are dry. The fibre is used like jute in the manufacture of sacks and cloth. A native of Madagascar can cut about 440 lbs. of green stems per day, and 100 lbs. of stems yield about 5 lbs. of dry fibre.

The crop may be sown broadcast or better by means of a drill, but it should always be sown thickly, to prevent branching and to obtain very long stems. There is little disadvantage in cutting after the maturation of the seed, the fibre being perhaps of slightly less fine quality.

Though the plant occurs in rich alluvial soils, it adapts itself also to poor soils.

1115 - *Agave Sisalana* and *Fourcroya gigantea* at Cape Verde. — *Revista Colonial*, Year II, No. 21, pp. 289-290. Lisbon, September 25, 1914.

Agave Sisalana was introduced into Cape Verde some years ago in the form of bulbils, which were distributed amongst the agriculturists in different localities. They appear to have struck wherever planted, but though they developed into good plants in the high lands and valleys, they were stunted in growth in the arid soils near the coast.

Fourcroya gigantea has been established in the wild state in the mountainous islands in the Cape Verde Archipelago for more than a century and in some places it covers considerable areas. The fibre is prepared by the natives, but in such a crude manner as to render it unfit for export. In 1908 private enterprise attempted mechanical extraction with considerable success, the fibre being now sold in the markets of Hamburg, London, Antwerp and Marseilles. In 1903 the Portuguese Government carried out experiments at the National Rope Factory (Cordoaria Nacional) with textile fibres from the colonies. *Fourcroya* fibre from Cape Verde was tested and gave good results.

On the initiative of the present Governor, important plantations of *Sisal* and *Fourcroya* have been established on certain State lands (Ruy Vaz, Cancelló, Trindade, at an altitude of 1000 to 2500 feet). At the beginning of April, 1914, 620 000 plants had been planted and 80 000 more will be planted before the end of the year. Since the bulbils require a considerable time to grow, plants which will begin to yield in 3 years and yield about 1 ton of fibre per 1000 plants per annum after 5 years, have been bought from the natives. The present price of the fibre is £ 30 per ton.

1116 — The Seeds of *Trichilia* from the Nigerian Sudan. — AMMANN, P. and VUILLET, J. in *L'Agronomie Coloniale*, Year 2, No. 14, pp. 34-36. Paris, 1914.

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TANNINS

The various species of *Trichilia* have not yet been thoroughly investigated, although they yield various interesting products; the bark of some of them is an excellent substitute for Ipecacuana, while their seeds contain varying quantities of fatty matter suitable for soap and candles.

M. F. PELLEGRIN, in a monograph on the Meliaceae of West Africa, enumerates 12 species of *Trichilia*, of which 6 belong to West Africa proper and 6 to Equatorial Africa. The six species belonging to West Africa are: *T. Priureana* A. Juss, *T. emetica* Vahl and *T. Hendelotti* Planchon, all of them small trees belonging to the savanna region; *T. acutifoliata*, *T. Candollei* and *T. cedrata*, all three described by A. Chevalier and forming large trees in the virgin forests of the Ivory Coast.

The seeds of *T. emetica* have been exported from Mozambique to Marseilles for a long time under the name of *Maturaires*. It was therefore desirable to know if the West African products gave seeds of equal value. Seeds were therefore obtained from various species found between Bamako and Koulikoro and studied at the Chemical Laboratory of the Colonial Garden of Vincennes. The types of seeds were as follows:

- I. Small dark red seeds.
- II. Medium-sized seeds of orange vermilion colour.
- III. Large orange-coloured seeds.

The results of the analyses are given in the Tables I and II.

TABLE I. — Analysis of seeds.

	I	II	III
Weight of 100 seeds, gms	12.7	29.4	79.1
" " 100 kernels, gms	4.68	17.08	46.04
Percentage of kernels in seeds	36.9	58.1	58.2
Shells %	63.1	41.9	41.8
Moisture % in shells	6.42	4.16	4.74
" " in kernels	5.73	6.71	5.76
Fat in shells	41.50	38.10	51.90
" kernels	30.10	44.70	43.70

TABLE II. — Analyses of the fats.

	Medium seeds. Fat of kernels	Large seeds. Fat of kernels Fat of shells	
Colour	light brown	light brown	lighter brown.
Solidification point of glycerides	180-190	150-160	about 130
Acidity % as sulphuric	0.97	0.49	0.53
" % as oleic acid	5.60	2.82	3.05
Fixed insoluble fatty acids %	92.0	90.3	92.0
Melting point of insoluble fatty acids	520	51.50	440
Solidification point " "	48.40	47.20	40.50
Glycerine %	6.3	—	5.8

The large seeds most nearly approach the Mafuraire from Mozambique as regards size and fat content. The medium seeds are identical with those of *T. Prieureanu* preserved in the Kew Museum.

French West Africa should be able to export at least several hundred tons of the Mafuraire seeds each year.

RUBBER,
GUM AND RESIN
PLANTS

1117 — **Recent Data on Rubber Plantations.** — Plantation Rubber Acreages. — Rubber Planting in Malaya. — WILLIAMS, G. C. (Rangoon): Rubber Cultivation in Burma — Report of Gold Coast Government. — *The India Rubber World*, Vol. 4, No. 6, pp. 678-679. New York, September 1, 1914. — Rubber Cultivation in India *Daily Consular and Trade Reports, Issued by the Bureau of Foreign and Domestic Commerce*, Year 17, No. 197, p. 1034. Washington, August 22, 1914.

The area under rubber in 1913 is estimated at 1 250 000 acres, distributed as follows:

Malaya, etc.	500 000	acre
Java.	150 000	„
Sumatra, etc.	250 000	„
Ceylon	220 000	„
India and Burma	50 000	„
German Colonies	60 000	„
Borneo	20 000	„

In 1910 the total acreage under rubber was 767 000 acres, in 1911, 865 000 and in 1912, 987 000. It will thus be seen that the increase shown by 1913 over 1912 is about 27 per cent.

The following table shows the relative importance of the rubber acreage in various parts of the Malayan peninsula:

	1912 Acreage	1913 Acreage	1913 Output in tons
Federated Malay States . . .	399 197	433 324	21 229
Straits Settlements	94 263	111 316	6 047
Johore	91 827	117 022	1 646
Kelantan and Kedah	34 837	45 373	246
Trengganu	1 497	1 510	Not yet producing
	621 621	708 545	29 168

In 1912 there were in all 235 912 workers employed on the Malayan estates.

The production of rubber in India is confined to Assam, Burma and the Madras Presidency, which exported in the fiscal years ending March 31, 1913 and 1914, 14 627 and 23 264 cwt. respectively. The acreage under rubber and the number of trees in 1913 was as follows:

	Acre	No. of trees
Assam	4 681	137 430
Madras	12 022	1 636 476
Burma	29 544	4 911 399

The yield of the Assam plantations is relatively small and the number of trees to the acre much less than in Madras and Burma. In 1913 the outturn of Madras was still more than double that of Burma, because most of the trees in Burma, being less than six years old, are not yet productive.

In 1914 the total acreage under rubber cultivation was about 34 000 acres. The rubber-growing districts are in Lower Burma, including Tenasserim. The soil is principally a reddish yellow friable sandy loam, with occasional districts which have a subsoil of laterite. The land is easily drainable. It is slightly undulating and in nearly all cases is protected from the south-west monsoon by high ranges of hills.

The rainfall varies slightly in different districts, from 110 inches in North Tenasserim to 200 in Tavoy. There are two seasons: December to April, the dry or cold season, and May to November, the wet or monsoon season. The driest months are February and March, when there is very little or no rain, but there are heavy mists and dews which compensate for the lack of rain. The temperature is about 88.8° F. in the daytime and 74° F. at night—the mean temperature for the year being about 80° F.

All planting is stump planting about 9 to 12 months old. The plants attain a height of from 10 to 12 feet and a girth average of $2\frac{1}{2}$ to 4 inches in one year. All the trees can be tapped in 4 years from the date of planting, the girth average 3 feet from the ground being 18 to 24 inches and more if planted 20 × 20 feet. The average yield for 4 to 6 year-old trees 1 $\frac{1}{2}$ to 3 lbs. per tree per year. The rubber is of excellent quality. Tapping can be done now practically all the year round. It is principally done by Burmese girls.

The capital invested is from £ 22 to £ 25 per acre to bring to bearing. The average cost of production is about 1s 6d to 1s 10 $\frac{1}{2}$ d per pound.

The exports of rubber from the Gold Coast Colony in 1912 were 1 990 699 lbs. as against 2 668 667 lbs. in 1904. The average annual yield of Para rubber (Hevea) at the several experimental stations was 3 $\frac{3}{4}$ lbs. per tree. *Funtumia* has given over 56 per cent of its total yield at the first tapping, in contrast with Para, where the quantity of latex tends to increase after the first tapping.

1118 — **Rubber: Tapping and Tapping Systems.** — SPRING, F. G. (paper read at Batavia Rubber Congress) in *The India Rubber Journal*, Vol. XLVIII, No. 14, pp. 15-16. London, October 3, 1914.

Under normal conditions from 300 to 350 trees per tapping coolie per day are recommended if work of good quality is to be maintained. At least twenty cuts to the inch of bark removed should be obtained, and when four years is allowed for bark renewal the cuts should be 18 inches apart. The depth and uniformity of cut are extremely important. It is considered a bad practice to place water on the cuts to facilitate the flow of latex.

In discussing the merits of the different tapping systems two points require consideration: 1) the production of maximum yield of rubber at minimum cost, and 2) the maximum yield of rubber with minimum injury to the tree. With regard to the periodicity of tapping it is generally

recognised in Malaya that daily tapping, over a period, gives more total rubber than alternate-day tapping, but that the latter yields more per tapping. In the case of young rubber, the difference is at its minimum, but as the tree ages the excess of rubber obtained in daily tapping increases and becomes sufficient to pay for the additional labour involved. This age limit appears to be about six years for trees planted at sufficient distance apart to allow good bark renewal. Bark renewal depends on the age of the trees and their distance apart.

At least four years should be allowed for bark renewal in the case of young trees and six years for old trees, especially if the distance of planting is small.

The writer has conducted experiments to test the merits of the following tapping systems:

1. *Opposite quarter system.* — This system is unsatisfactory on account of the high cost of marking out the guiding lines, tapping, collecting latex and washing cups, and requires double the number of latex cups, spouts and holders. It is also doubtful if the renewal of bark in this system is as rapid as in others.

2. *Single quarter (or half herringbone) system.* — This system is largely in use in the Malay Peninsula. At the Kuala Lumpur Experimental Station it was found that two cuts gave considerably more total rubber than three in the case of young trees, and since the length of the cuts increases with the age of the tree, it is doubtful if it is advisable to have more than two cuts even with old trees. It has been found in Java (1) that more rubber is obtained by tapping to the left than to the right of the vertical channel. This system is infinitely superior to the opposite quarters system and over a period of two years it has given results nearly equal to the 'V' system. The superiority of the latter system cannot be decided until the results of tapping the renewed bark are known.

3. *The 'V' system.* — Some planters object to this system since it tends to flatten out the trunk of the tree. This is however no disadvantage and the results of the Kuala Lumpur experiments show a gradual and continuous increase in yield greater than that of any other system.

SUGAR CROPS

1119 — *The Use of Sweet Sorghum as a Source of Commercial Sugar or as Fodder.* — ANNETT, H. E., (Agricultural Chemist to the Government of Bengal) in *Agricultural Research Institute, Pusa, Bulletin* No. 41, 9 pp. + 2 diagrams. Calcutta, 1914.

From time to time attempts have been made to grow sweet varieties of sweet jowar (*Sorghum* sp.) for the purpose of sugar production. The seed has in many cases been imported from America, but in certain parts of India local varieties are found which contain much sugar.

The experiments here described were made at Lyallpur and at Gurdaspur, Punjab.

At Lyallpur a local variety was grown. It was sown on July 26 at the rate of 12 lbs. per acre, without manure; the ground was irrigated four times. In order to determine the best time for the harvest, the whole

(1) See No. 1039, B. Sept. 1913.

plot was divided into 20 equal sections which were gathered two at a time at 10 different intervals. From every lot the juice was boiled down. The best results were obtained from the sections cut towards the end of October or beginning of November. The lot cut on November 9 yielded 6 tons to the acre of stripped cane with 6587 $\frac{1}{2}$ lbs. of juice, and from this 875 lbs. of raw sugar (gur), or 13.3 per cent, containing 57.90 per cent sucrose and 13.42 per cent reducing sugar, were obtained. This is quite a poor quality gur.

From the results of the Lyallpur and Gurdaspur experiments it appears that as a source of sugar, saccharine jowar is not worth growing in India. Even in America it is only grown to make syrup, for which there is a demand in that country, while there is none in India.

The high glucose ratio of the juice militates against the production of good crystalline gur. The juice contains also substances which produce, at times, a very objectionable taste in the gur.

The yield per acre obtained from a very good crop of sorghum only worked out at about 8 cwt. per acre. Hence the yield of sugar per acre would be only about one-third of that from the average country sugarcane crop.

These results tally with others obtained previously at Poona with the Collier and Amber varieties, which yielded 1174 and 1072 lbs. of molasses per acre respectively.

The experiments made by the writer indicate that the total sugar content of the crop is highest when the seed contents begin to dry. Thereafter until the seeds are dead ripe the total sugar in the crop decreases, but the decrease is mainly at the expense of the reducing sugar. As the plant approaches ripeness the amount of juice expressed from it decreases.

As a source of fodder saccharine sorghum seems valuable. The crop is fairly quick-growing and, as has been seen, yields abundant green produce. After the seed is in the thin milk stage no increase in total weight of the crop takes place and also the amount of total sugar in the crop has almost reached its maximum. Hence, when being cut for fodder, the crop should not be allowed to get beyond this stage.

1129 - Tea: Manuring Experiments at Peradeniya. — BAMBER, M. K., in *Department of Agriculture, Bulletin* No. 9, pp. 119-134, 3 plates. Colombo, Ceylon, May 1914.

This circular contains a detailed account of the results of manurial experiments on the tea plots at Peradeniya since 1911. Though no obvious conclusions are drawn from the tabulated results, the writer states that the experiments continue to bear out the advantages of green manuring, and demonstrate that with this class of tea, the application of expensive nitrogenous manure is not essential for the production of highly profitable yields.

As a green manure, *Dadaps* (*Erythrina lithosperma*) appears to give the best results.

STIMULANT,
AROMATIC,
NARCOTIC,
AND MEDICINAL
CROPS

1121 - **Irises Used in Scent-Making.** — BLIN, HENRI, in *Le Jardin*, Year XXVIII, No. 659, pp. 230-231. Paris, August 5, 1914.

France does not produce sufficient iris rhizomes to supply the scent factory at Grasses (Alpes Maritimes), where 650 000 lbs. are required annually; therefore there is a large importation of these roots from Tuscany. Further the Italian product is of superior quality to the French. The writer is of opinion that iris cultivation might be extended in the South of France, and especially on the somewhat poor soil of the coast zone, which is not far from the centres of perfume manufacture.

The scent iris was grown for a long time in the Department of the Ain, in the communes of Angelfort and Carbonnot, near Seyssel. This crop has, however, decreased in importance owing to the competition of the South of France and of Italy. In 1903, the above-named communes produced from 33 000 to 35 000 lbs. of iris rhizomes, which fetched from 40 to 50s per cwt. The price has now fallen to about half this. Iris roots from Florence make 35 to 50s per cwt., while the less valuable ones from Verona are sold at 25 to 30s.

The varieties most used in scent-making are *Iris florentina* (*I. pallida*) and *I. Clio*, which is a variety of it. *Iris germanica*, which is coarser and hardier, grows wild throughout Provence.

The soil is prepared by digging, and fragments of the rhizomes are planted at 8 inches each way, towards the end of August and in September. They are hoed in spring and autumn. From 6 to 8 tons of manure are applied per acre to every crop, which occupies the ground for two or three years. In the South of France, good results are obtained by the application of 6 to 8 cwt. per acre of sesame or oil cake. The rhizomes are lifted at the end of the second or third year. The French crops vary from 20 to 36 cwt. of dry rhizomes per acre. An average crop of 28 cwt. per acre, fetching 28s per cwt., gives a gross return of £ 40 per acre.

The rhizomes are peeled, washed, dried in the sun and kept in a dry place. The old method of making the scent consisted in grinding the dry roots and thus obtaining iris powder (which is itself used for many purposes). The essence was distilled and the residual powder macerated in pure alcohol, either the essence or the maceration liquid being used. The better and more modern method is the process of extraction by means of volatile solvents such as dichlorethylene or trichlorethylene; the latter is preferable for manufacture on a large scale.

1122 - **The Effect of Shading on the Transpiration and Assimilation of the Tobacco Plant in Cuba.** — HASSELBRING, HEINRICH, in *The Botanical Gazette*, Vol. LVII, No. 4, pp. 257-286, + 1 fig. Chicago, Ill., 1914.

The experiments described in this paper were undertaken in the year 1908-09 at the Cuban Agricultural Experiment Station at Santiago de las Vegas (Western Cuba) with the object of determining the effect on transpiration and assimilation in the tobacco plant of the cheese-cloth shade which is frequently used in that region for shading tobacco. This cheese cloth is a kind of network of coarse thread with meshes about a tenth of an inch wide; during the middle of the day this cloth casts a barely

perceptible shadow, which, however, is more noticeable early in the morning or late in the afternoon.

Six tobacco plants were grown in vessels in the open, and six under cheese-cloth shade. The light intensity under the two conditions was measured by the photometric method. The temperatures were recorded by thermographs; the relative humidity and rainfall were also determined.

It was observed that:

1. The shade of the cheese-cloth tent reduced the total light by about one-third, but the diffuse light showed very little difference on bright days; when, however, there was no bright sun the total light (all diffuse) was reduced by about one-third.

2. There was no marked difference between the temperature within the tent and that outside. The average daily excess of the temperature outside the tent over that inside was, for 60 days, 0.14° F. It seems that the tendency of the tent to retain heat is balanced by the smaller quantity of radiant energy which passes into it.

3. The relative humidity is higher inside the tent than outside, the difference being more marked during the day, for at night in both stations it reaches 100 per cent. During the day the difference is enhanced by the partial retention of the moisture transpired by the plant.

4. The rate of evaporation is greater in the open than under the tent. The difference in the rates of evaporation in the two stations increases with the development of the plants and the consequent increase in relative humidity under the cheese-cloth. Besides diminishing the amount of light and increasing the relative humidity, the tent reduces the currents of air; all these changes tend to diminish transpiration.

The plants used in this work were grown from seed obtained from a single self-fertilized mother-plant of a pure strain.

The shade plants attained a nearly uniform height of 6 ft. 10 in., while the height of the sun plants averaged about 5 ft. 9 in. The leaves of the shade plants were much larger and thinner than those of the sun plants and the internodes of the stem were longer. In 60 days the plants in the open transpired an average of 45.539 litres of water per plant and required 241.72 cc. of transpired water per gram of water-free substance produced, while the corresponding figures for the shade plants were 35.212 litres and 186.90 cc. The sun plants thus transpired on the average about 30 per cent more water per plant than the shade plants, while the average weight of dry matter produced was, in the mature plants, nearly the same in both sets. It follows that the series having the higher total transpiration also has the highest transpiration per gram of dry plant substance. This is corroborated by the above figures. The quantity of water transpired per unit of dry matter produced is remarkably uniform for the plants within each group. This confirms the conclusion that under the same aërial conditions the quantity of water transpired per unit of dry matter produced is constant and independent of the nature of the nutritive solutions or of their concentration or of the state of development of the plant.

The other observations gave the following averages per plant:

	Plants in the open	Plants shade
<i>Leaf area</i> , in square centimetres	21 442	29 442
<i>Transpiration</i> , total for the last five days, in cc. .	10 565	7 862
" hourly per sq. decimeter leaf surface,		
in cc.	0.412	0.224
<i>Fresh weight</i> , in grams:		
leaves	401	469
stems	380	489
roots	212	205
total	993	1162
<i>Weight of water-free substance of plants</i> (at 78° C.		
and at a pressure of 6 cm. mercury) in grams		
leaves	74.50	66.94
stems	68.66	79.68
roots	45.26	41.51
total	188.42	188.14
<i>Percentage of water</i> .		
leaves	81.39	85.68
stems	81.91	83.71
roots	78.59	79.70
total	81.01	83.82

After a discussion of the observations and opinions of the most competent authorities on the subject of the relation between transpiration and production of plant substance, the writer draws the following conclusions:

Under the climatic conditions of Western Cuba the transpiration of tobacco plants grown in the open ground is nearly 30 per cent greater than that of plants grown under the cheese-cloth shade commonly used for shading tobacco in that region. The transpiration per unit area of leaf surface is nearly twice as great in the sun plants as in the shade plants.

The shading of tobacco plants by this grade of cheese-cloth does not seem to result in a diminished production of total plant substance by the shaded plants, as compared with other like plants not shaded. Since, however, the leaves of the shade-grown plants have a much greater total area than those of the plants grown in the open, it is evident that the quantity of plant material elaborated per unit of leaf area is greater in the plants grown in the open.

Although the total production of dry plant substance is not influenced in any marked degree by the cheese-cloth shade, the distribution of this substance is affected in such a manner that in the shade-grown plants relatively less material is deposited in the leaves and more in the stems than in the corresponding organs of the plants grown in full light. No evident influence is exerted on the deposition of material in the roots.

1123 — *Medicinal Plants in South Africa*. — SCHÖNLAND, S., (Professor of Botany, Rhodes University College) in *The Agricultural Journal of the Union of South Africa*, Vol. VIII, No. 2, pp. 201-205. Pretoria, August 1914.

In South Africa the native medical practitioners make use of a number of local plants; very few of these, however, are included in the official phar-

macopoeia. Among these the following wild plants may be mentioned: *Brassica nigra*, which is widely spread in South Africa; *Cannabis sativa*; several species of *Cassia*; *Datura Stramonium*; *Foeniculum vulgare*, *Marrubium vulgare*; several native species of *Polygala*, which appear to be at least as good as *P. Senega*; *Ricinus communis*, etc.

Numerous other medicinal plants have been grown here and there in South Africa, but rather for experimental or ornamental purposes and without attaining any commercial importance. Among these the following have been successful: *Aloe* (Barbados) at Grahamstown and Capetown; *Aspidium athamanticum* Kze, which is said to be superior to male fern, at Salem; *Carum Carvi* near East London; *Cassia marilandica* at Komgha; *Cinnamomum Cassia* at Durban and Maritzburg; *Convolvulus Scammonia* at Somerset East; *Coriandrum sativum* near East London; *Curcuma longa* in Natal; *Digitalis purpurea* in Albany; *Erythroxylon coca* in Natal; *Glycyrrhiza glabra* near East London; *Illicium verum* in a garden at Komgha as an ornamental plant; *Linum usitatissimum*, it grows freely at Komgha and Kei River, and has been very successfully grown near East London and in Lower Albany; *Matricaria Chamomilla*, grows freely at Komgha and was grown at Salem for many years; *Menta piperita*, successfully grown in several localities; *Pimpinella Anisum* near East London; *Pyrethrum* spp. have been grown very successfully for local consumption in South-east Cape Colony; *Rheum officinale*, successful at Komgha; *Tamarindus indica*, grows freely at Komgha, also grown at Durban, where it does not bear pods freely enough to make it worth cultivating; *Taraxacum officinale*, near East London.

Considering the special economic conditions of South Africa and especially that labour is expensive, mostly unskilled and unreliable, the writer does not believe that an important export trade in medicinal plants could be built up, even with those abundantly growing wild.

1124 - Market Gardening in Spain. — ZULUETA, JOSÉ (Report presented to the VIII «Curso Internacional de Expansión Comercial») in *Resumen de Agricultura*, Year XXVI, Part 309, pp. 390-398. Barcelona, September 1924.

MARKET
GARDENING

The exportation of market-garden produce from Spain is continually increasing with the improvement of the means of communication. According to the last available official statistics, those of 1912, the exports during that year were as follows:

	£
Onions	624 873
Preserved vegetables	370 550
Potatoes	278 270
Chillies, ground and unground.	181 315
Garlic	87 908
Tomatoes	37 382
Peas	10 930
Artichokes	650
Capsicums	159
Asparagus	29
Various vegetables	9 583

The statistics estimate the value of the annual vegetable production of Spain at 15 millions sterling. The writer, however, considers that this estimate falls far short of the reality, seeing that vegetables form the principal articles of food of the people. The above figures do not include all the vegetables consumed by the producers. Very many families possess kitchen gardens; even agricultural labourers and some towns-folk and factory hands possess them.

With the exception of Madrid, where the scarcity of water in the Manzanares precludes irrigation, all the large centres of population in Spain are surrounded by belts of market gardens. In the central "meseta" (plain), the first place is occupied by Aranjuez, with its 30 000 acres of well irrigated land thickly covered with market gardens and associated fruit plantations. In Aragon the irrigated land of Calatayud is noted; however, both in this district and in the "vegas" (fertile, gentle irrigated slopes at the foot of the mountains) of Saragossa, sugar-beets and lucerne predominate, so that market gardening has little commercial importance. The valley of the Ebro is only to a limited extent under intensive cultivation; however, Logroño Haro should be singled out, as it supplies a large preserve trade.

The typical market-garden zone which produces early outdoor vegetables, is the coast zone of the Mediterranean. From the town of Mataró the "huerta" (irrigated fruit and vegetable garden), extending as a long narrow belt along the coast from the suburbs of Barcellona to the French frontier, takes its name. Its speciality is in early potatoes, which are planted in November or December, and forced by the application of an abundant supply of manure; these potatoes are sent, in constantly increasing quantities to Paris and to England and elsewhere at a time when the tubers are still green. The annual exportation is estimated at 33 million lbs., and its value at £120 000; but the price varies very much according to the greater or less competition of the products of other warm countries. The exportation of green peas is estimated at 3 ½ million lbs., with an average value of £12 000; these are grown without irrigation between rows of vines. In the "huerta" of Mataró no fruit trees are grown, while the more extensive plain of the Llobregat, which occupies the whole delta and extends some miles up the valley, is an uninterrupted fruit plantation, with vegetables below the trees.

According to official data, which, however, fall below the actual figures, the province of Barcelona possesses 16 200 acres of market gardens, of which the produce is worth £1 290 000. The name of "huerta" is not given to the cultivated zone extending between Rens and Tarragona; nevertheless the scanty water supply available is turned to such good account, that large crops of vegetables are also obtained there. The "huerta" proper commences in the Castellón plain and includes all the ancient kingdom of Valencia, where it reaches its greatest perfection. The Villareal "huerta", which now comprises about 2500 acres, uses subterranean water brought to the surface from a depth of about 200 ft. by means of Artesian wells with mechanical motor pumps. On an

average there is one well for every 57 acres of land, which is for the most part under citrus groves. The soil was prepared according to the system used in Santa Cruz (Teneriffe) in preparing the land for the celebrated Canary tomatoes: the solid rock is blown up with dynamite, the layer of earth beneath is extracted, the cavity is lined with fragments of rock and filled up with soil. At Villareal, however, the soil was transported for a long distance in order to obtain a layer 20 in. deep. The same thing is done at Almeria in order that the roots of the famous vines can penetrate deep into the soil and thus resist the drought. In the "huerta" of Valencia the cultivation is so intensive that there are families living upon little over an acre of land.

The "huerta" of Murcia is distinguished by the cultivation of cap-sicum. Vegetables are grown there in trenches covered during the winter with straw matting. Orihuela, Denia, Gandía, the "vega" of Granada and Motril are all important horticultural centres. The Motril zone is especially characterised by the cultivation of cotton and sugarcane.

The prices of "huerta" in full production are exceedingly high, rents amounting to £10 or £16 per acre and sale prices usually to £200 to £300 per acre. At Carcagente, Alcira and Gandía, citrus groves fetch as much as from £650 to £800 per acre.

As a rule, the ground is leased to families of colonists who usually do all the work; day labourers are very rarely employed. The management of the soil and the crops is carried out with the greatest exactitude.

1125 - **A Kaki Classification.** — HUME, HAROLD H., in *The Journal of Heredity*, Vol. V No. 9., pp. 400-406 + 6 figs. Washington, September 1914.

As long as any kind of fruit is represented by only a few varieties the botanical classification can be followed, but when the number of varieties increases considerably, it becomes necessary for the pomologist to introduce some system of classification based on some well-marked characteristic in order to facilitate identification and handling.

Such is the case with the Kaki (*Diospyros Kaki*) of which the number of varieties grown in the United States for many years has been quite limited. But recently a very large number of new varieties have been introduced from China, Japan, Algeria, France, etc.

The writer is of opinion that the flesh characters form a satisfactory basis of classification. In the final analysis the flesh characters are fixed by the pollination factor and this factor finds its most striking expression in the colour and texture of the flesh.

All the varieties of *D. Kaki* known in America at this time are light fleshed when seedless, while certain varieties always show darkening of the flesh when seeds are present and other varieties are always light fleshed when containing seeds. Thus far in the writer's experiments parthenogenesis, that is the formation of seeds without pollination, does not occur in *D. Kaki*, and if it does it is so rare as to have no practical importance. In *D. virginiana* it is said to have been observed in some instances, but it has not been proved experimentally.

Kakis may be divided from the pomologist's point of view into at least two groups — first those which show no change in colour under the influence of pollination, and second those in which the flesh of the fruit is darkened under the influence of pollination.

Since the change in colour in the one case is directly due to pollination and in the other pollination has no effect, those varieties which undergo no change in color are called *Pollination Constants* and those which are light coloured when seedless and dark coloured when containing seed are called *Pollination Variants*. If varieties which are constantly dark fleshed whether seedy or seedless should be found, they would belong to the group of *Pollination Constants*, which would be divided into two groups of light and dark fleshed *Pollination Constants*. It is hardly probable that there are varieties which are dark fleshed when seedless and light fleshed when seedy.

The varieties known at this time are divided as follows :

Group I, *Pollination constants*, Costata, Hachiya, Lienha, New Sien, Ormond, Phelps Siang, Tamopan, Tanenashi, Triumph, Tsuru.

Group II, *Pollination Variants*: Dai Dai Maru, Gailey, Godbey, Hyakusae, Lonestar, Masugata, Myotan, Nectar, Okame, Taber No. 23, Taber N. 129, Yeddoichi, Yemon, Zengi.

The amount of dark flesh found in fruits of varieties of the group *Pollination Variants* depends both upon the number of seeds and upon their location with reference to one another: It is partial or arranged round the seeds when only one or two close to each other are present; if two seeds are present diametrically opposite one another, or if there are more than two seeds, the whole area may be more or less darkened.

Associated with the changes in the colour of the flesh there are well marked variations in time of ripening, shape and size of fruits, quality and texture of flesh.

Considering the extraordinary variability shown by *D. Kaki* due to cultivation, it is not improbable that the present cultivated varieties are derived from two distinct species.

Certain varieties of kakis bear both staminate and pistillate flowers. Some of those which bear staminate flowers do so every time the tree blooms, while other varieties are very irregular in this particular. The first class of staminate trees are designated as *Staminate Constants*, while the second class may be called *Staminate Sporadics*. Those which produce only pistillate flowers may be referred to as *Pistillate Constants*. It is interesting to note that staminate-flowering varieties of both classes are more commonly found among the *Pollination Variants* than among the *Pollination Constants*. To the former group belong Gailey, Masugata, Okame, Taber Nos. 23 and 129. Among the *Pollination Constants* only two staminate-flowering sorts, viz. New Sien and Siang, have so far been found. It is not improbable that they belong to a different species from the other varieties or at least a different section of *D. Kaki*. These two varieties were recently introduced from Northern China. It must be borne in mind that *D. Kaki* is not native to Japan, but was introduced from China several centuries ago; no

doubt the two groups (light-fleshed and dark-fleshed) have diverged greatly, even granting that they were originally one.

The different varieties so far studied may be grouped on the flowering habit as follows:

Group I: *Pistillate Constants*. Tanenashi, Hachiya, Costata, Tsuru, Tamopan, Hyakume, Yenon, Yeddoichi, Phelps, Triumph, Zengi.

Group II: *Staminate Constants*. Gailey, and probably Masugata, Siang (S. P. J. No. 21910 and S. P. J. No. 27037).

Group III: *Staminate Sporadics*. Okame, Taber No. 23, Taber No. 129.

Experiments conducted by the writer tend to prove that it is possible by selection to transform strains of staminate sporadics into staminate constants.

1126 — **The Siamese Seedless Pomelo.** — BOYLE, H. H. (Bureau of Agriculture, Manila, P. I.) in *The Journal of Heredity*, Vol. V, No. 10, pp. 440-444 + 1 fig. Washington, October 1914.

In 1902 the Office of Foreign Seed and Plant Introduction of the U. S. Department of Agriculture introduced from Bangkok some plants of the Siamese pomelo which had been described as seedless. But the only plant which reached Washington alive produced fruit which contained many seeds and was decidedly inferior; it was consequently destroyed.

In 1912 the writer was sent by the Philippine Bureau of Agriculture to Siam to study the seedless pomelo on the spot and to obtain plants of it. He was able to find it about 30 miles to the north-east of Bangkok and in the Nakon Chaisii district, which produces the best pomelos. He found that some trees bore only seedless fruit, but some also bore fruit with seeds, especially those trees which stood on the side of the grove nearest the ordinary seminiferous pomelo trees; the presence of seeds was apparently due to cross-pollination. The seedless pomelos are all propagated by marcottage by the natives, to whom budding is unknown. In research work carried on in the United States it had already been observed that the seedless navel orange bore seeds when crossed by pomelo.

The writer classifies the seedless pomelos of the Nakon Chaisii district according to four types:

1. Medium size, $4\frac{1}{2}$ inches in diameter by 5 inches in length; colour light yellow; flesh white; taste very aromatic, free from bitterness.

2. Medium size, $4\frac{7}{8}$ inches in diameter by $3\frac{1}{4}$ in length; colour bright yellow; flesh white; taste aromatic and excellent.

3. Medium size, about the same as No. 1, pyriform; colour orange yellow; flesh pinkish white; taste good, rather heavy.

4. Size very large; colour yellow; flesh deep pink; taste bitter.

Type 1 is the finest of all, Types 2 and 3 are the commonest, while Type 4 is inferior to the others.

The Siamese seedless pomelo has been introduced into the Philippines and into the United States.

1127 - *Prosopis juliflora*, the Mesquite or Algaroba Tree, and *Prosopis pubescens*, the Screw Bean. — ROBERTSON, C. C. (Research Officer, Forest Department) in *The Agricultural Journal of the Union of South Africa*, Vol. VIII, No. 2, pp. 233-239. Pretoria, August 1914.

The Mesquite or Algaroba and the Screw Bean or Screw Pod Mesquite deserve to be introduced and grown for their pods, which are excellent fodder for live stock.

Prosopis juliflora, the mesquite, is widely distributed in North America from Western Kansas to California and southwards into Mexico, and probably various forms occurring in Central and South America and there known as algaroba should be included in the same species. Even in the United States the species varies a good deal, and two extreme forms, the varieties *glandulosa* and *velutina*, are recognized.

The mature pods are yellow, or often tinged with red, and are about four to nine inches long and one-third of an inch wide, and contain about six to twenty seeds embedded in pulp.

In its home in North America, *Prosopis juliflora* is found in the hotter, drier parts of the country, where the average annual rainfall is about 25 inches; it occurs even in arid localities where the rainfall is as low as 10 inches. It develops a remarkably long taproot, which enables it to derive moisture from a great depth and to become independent of the surface water supply. It grows to a height of from 3 to 20 feet. The *velutina* variety reaches its greatest height of about 40 feet and a diameter of $1\frac{1}{2}$ or 2 feet in the valleys of Southern Arizona. The species is said to be extending its range naturally in some of the prairie States, and in California it will grow on soils containing a large proportion of carbonate of soda.

Prosopis juliflora has been naturalized in several countries. It is abundant in the drier parts of the island of Jamaica, where it grows in dry gravelly soils. In the Hawaiian Islands it has spread rapidly since its introduction about 70 years ago and now covers an area of at least 50 000 acres on the south and west coasts, where it is protected from the trade winds. It grows on gravelly soils and steep stony slopes, occupying land which is worthless for other purposes.

In some of the drier parts of India, *Prosopis juliflora* is now naturalized and has proved extremely hardy to drought and is used for reforesting dry, waste lands and for arresting drift-sands. The tree is also said to be naturalized in the Philippine Islands and in Australia.

In German West Africa it was introduced about thirteen years ago and seems to withstand the drought well and to grow on poor soil.

Seed of *Prosopis* and its varieties has been imported from different sources by the Forest Department of the Union of South Africa at intervals during the last seventeen years. It seems to thrive in the different localities in which it has been planted, but its growth has been somewhat slow and bushy, and the writer recommends it for hedges and for arresting sand-dunes.

Wherever it has been introduced it is extending its range naturally by regeneration from seed which is disseminated by stock in their droppings. It is of slow growth. Its wood is heavy, hard and close-grained.

It has been used for railway sleepers, wood-paving, fence-posts and furniture. It is an excellent firewood and makes good charcoal. The flowers are eagerly sought by bees. The pods are relished by cattle, horses and pigs and form an important stand-by for times of drought. About 53 per cent of their weight is nutritious and consists of vegetable albumen, gum, grape-sugar, with traces of fat and salts.

The Mexicans and Indians grind the pods into a coarse flour which they bake into cakes for food. In the Argentine a liquor is distilled from the pods.

Prosopis pubescens is distinguished from the other mesquite by its pods, which are twisted into a spiral. Its wood is similar to that of *P. juliflora*. The pods, although nutritious and used for fodder in America, are of less value because of their smaller size. This species has also been successfully introduced into South Africa.

1128 - **The Jaboticaba (*Myrciaria*).** — POPENOE, WILSON (Agricultural Explorer, U. S. Department of Agriculture), in *The Journal of Heredity*, Vol. V, No. 7, pp. 318-326. Washington, D. C., July 1914.

The jaboticaba is a fruit tree belonging to the Myrtaceae, indigenous to central and southern Brazil. Berg distinguished three species: *Myrciaria cauliflora*, *M. Jaboticaba* and *M. trunciflora*; but they are not distinguishable with certainty, at any rate under cultivation.

The tree, which is evergreen, may reach 30 to 40 ft. in height; it branches from the ground, producing an almost spherical crown. The fruits are borne on the branches from the ground-level to their tips; they are nearly sessile in *M. cauliflora*, but in *M. Jaboticaba* are produced on slender peduncles less than an inch long; they ripen within two or three months of the flowering period, and a tree may flower and fruit several times during the year. In appearance the fruits rather resemble large grapes, reaching 1 in. or more in diameter in *M. cauliflora*; the most usual colour is a deep maroon purple; the skin contains tannin and is rejected, while the pulp is translucent and juicy, in flavour something like grapes; each fruit contains from one to four seeds.

The jaboticaba will not stand more than the lightest frosts; it seems to prefer a rich, deep soil. The trees should be planted 30 ft. apart; when grown from seed (which is the usual method of propagation) they require six to eight years to come into bearing.

1129 - **Manurial Experiments on Coconuts at Peradeniya.** — BAMBER, M. KELWAY, in *Department of Agriculture, Ceylon, Bulletin* No. 10, pp. 135-146. Colombo, May 1914.

These experiments were conducted, to determine the effect of manurial constituents, alone and in combination, on the development and formation of nuts and to what extent old coconut palms can be improved by means available to most cultivators. The trees used were all old, growing on a quartz loam at an elevation of about 1600 feet and about 51 miles from the sea in a direct line. The rainfall of the district varied between 62.37 inches in 1908 and 120.70 inches in 1913 and averaged 83.35 inches.

The results tend to show that:

- 1). Ploughing twice a year is as beneficial as manuring.
- 2). Tying cattle to the trees in 1911 and 1912 had an immediate effect lasting over two years.
- 3). The application of a soluble manure twice annually and a general manure annually produced a steady increase which was maintained during 1913.
- 4). Green manure with basic slag and sulphate of potash showed a marked improvement, which, however, was not fully maintained during the wet season of 1913.
- 5). The application of salt (NaCl) or nitrate of soda has had no beneficial effect during the years of the experiment.
- 6). No treatment of any kind results in a gradual falling off in yield.
- 7). The effect of cultivation and manuring has not so far decreased the number of immature nuts (1) falling annually.
- 8). The number of mature and immature nuts increased annually, while the proportion of female flowers producing mature fruit showed a steady decrease during the same period.
- 9). The reduction of the percentage of mature nuts to female flowers is rather more marked in the manured plots than in the unmanured, but the percentage increase of total female flowers is more marked in the unmanured plots.

1130 - **The Manuring of Bananas** (2). — BRÜNNICH, J. C. (Chemist of the Department of Agriculture and Stock, Queensland) in *The Queensland Agricultural Journal*, Vol. II, Part 2, pp. 132-141. Brisbane, August 1914.

Hitherto, in general, large areas under bananas have been for years continually cropped, without any attention to manuring, and abandoned when the crop, became unprofitable owing to exhaustion of the soil.

In the State of Queensland it was found that the abandoned banana lands were eminently suitable to other crops and more particularly sugarcane, and thus the great waste of leaving stretches of land uncultivated was avoided, but the production of bananas, which in 1898 had been $4\frac{1}{2}$ million bunches, dropped to an average yield of a little over one million bunches in the last few years.

Several manurial experiments carried out in Southern Queensland under sub-tropical conditions, gave excellent results and demonstrated that exhausted banana lands may, by thorough cultivation and heavy dressings of fertilizers, produce crops equalling those obtained from virgin lands, provided that they be in good physical condition, and above all, contain a fair amount of humus. From what has been written about bananas in different countries it appears that they require a well drained loamy soil, containing a fair amount of humus, and good amounts of potash, lime and phosphoric acid in readily available form.

With regard to the conservation of humus, a good deal is returned to the soil by the rotting of the stalks on the ground after the bunches

(1) See also No. 248, *B. March* 1914.

(Ed.).

(2) See also No. 1278, *B. Sept.* 1912.

(Ed.).

have been cut. The growing of green manure crops like velvet beans, Mauritius beans, etc., is practised in some localities and can be strongly recommended.

No other cultivated plant exhausts the soil to such an extent as bananas. This is fully borne out by the following analyses carried out in the Queensland Departmental chemical laboratory, on virgin soil and exhausted banana land, both taken from Buderim Mountain, where the soil is a volcanic sandy loam.

	Virgin soil per cent.	Exhausted land per cent.
Humus and other organic matter	18.86	17.04
Nitrogen	0.560	0.292
Lime	0.450	0.180
Potash	0.109	0.067
Phosphoric acid, soluble in 1 per cent. citric acid	0.0142	0.0634

This is confirmed also by analyses, made in the same laboratory, of the fruit and of different parts of the plant of three varieties of bananas. They show that a fair crop of Cavendish bananas (555 bunches per acre, weight of bunch 39 lbs.) removes in the fruit 123 lbs. of potash, 12½ lbs. of phosphoric acid and 43.7 lbs. of nitrogen, whilst the stalks left on the ground contain 150 lbs. of potash, 6 lbs. of phosphoric acid and 41.4 lbs. of nitrogen. Practically speaking therefore 273 lbs. of potash, or about 5 cwt. of sulphate of potash per acre, must be available to the banana plant in a readily assimilable form to produce its growth and crop in a few months.

In the manuring experiments conducted by the writer on Buderim Mountain, 160 lbs. of potash, 80 lbs. of phosphoric acid and 40 lbs. of nitrogen per acre were applied to normal crops and in double quantities to the exhausted lands, the composition of which is given above.

The unmanured and lightly manured experiments showed the want of vigour in the plants; the banana sucker, as soon as the bunch appears, seems to lose its vitality; the leaves drop off and the stalk bends over and often breaks under the weight of the small bunch. On the other hand the heavily manured plots produce good heavy bunches and the plants withstand better the cold weather during the winter.

In some cases very heavy manuring was tried, as much as two tons of artificials being given yearly, at a cost of £ 25 per acre, and, in the plots where lime was applied, attaining £ 29 per acre.

The average yield of the eight experimental plots (K. P. N, see Table) for three years was 345 bunches with 3035 dozens of bananas per acre per annum, valued £ 38, the artificial fertiliser costing annually about £ 12 10s.

In the experiments 2 (K P N) the average yield was 457 bunches, with 4330 dozens of a value of £ 54 per acre, showing an increased net profit over the yield obtained from the preceding plots.

These experiments further showed that nitrogen acts best in form of dried blood and as nitrate of lime, that the addition of salt to the manure does not appear to make any appreciable difference, and that in the case of old plantations it is best to apply part of the artificials in holes made

Crop Results of Manuring Experiments on Buderim Mountain.

Number of Experiment	Fertilizers Used	Average yield per acre	
		No. of bunches	Dozens
1	K P N b	156	1 348
2	2 (K P N b)	243	1 900
3	$\frac{1}{2}$ (K P N b)	132	762
4	Nil	20	110
5	$\frac{1}{2}$ (K P Nn)	216	1 510
6	2 (K P Nn)	372	3 412
7	K P Nn	315	2 551
8	K Pt Na	221	1 937
9	2 (K P Na)	410	3 508
10	K Pt Na	350	3 118
11	2 (K P Nb)	388	3 266
12	2 (K P Nn)	471	4 237
13	2 (K P Nn) + salt	428	3 478
14	2 (K P Nb) + salt	410	3 347
15	Nil	273	1 760
16	Nil + lime	323	2 163
17	2 (K P Nn) + lime	388	3 322
18	2 (K P Nb) + lime	421	3 532
19	2 (K P Nn) + lime + salt	356	3 087
20	2 (K P Nb) + lime + salt	374	2 989

The figures of the first 10 experiments are averages of four years; those of the other of three years ending in 1914.

K = 160 lb. K_2O applied as 320 lb. potassium sulphate per acre.

Nb = 40 lb. N " " 290 lb. dried blood per acre.

Nn = 40 lb. N " " 290 lb. nitrate of lime per acre.

P = 40 lb. N " " 200 lb. ammonium sulphate per acre.

Pt = 80 lb. P_2O_5 " " 470 lb. superphosphates per acre.

2 (K P N) means double quantities; $\frac{1}{2}$ (K P N) means half quantities.

All manures applied twice a year — in spring and autumn. Salt applied 2 cwt. per acre; lime applied in two dressings of 2 tons per acre.

with a crow-bar to a depth from 18 to 24 in. all round the banana stool at a distance of from 3 to 5 feet, and the rest as top dressing. Lastly, it appears that physical conditions of the soil are improved by cultivation and manuring.

In the close neighbourhood of the experimental plots other persons carried out some experiments which proved that manuring with insuf-

ficient potash yields disappointing results and that on virgin soil the application of the standard fertilizer mixture, K P N, gave the most profitable harvest, namely £62 2s. 3d. per acre.

The table includes the results obtained by the writer. The literature quoted in the paper mentions twelve works.

1131 - A New Oak for Breeders: *Quercus insignis*. — *The Journal of Heredity*, Vol. V, No. 9, pp. 406-407 + 1 plate. Washington, September 1914.

FORESTRY

Dr. WILLIAM TRELEASE, of the University of Illinois, has called the attention of the American Genetic Association of Washington to *Quercus insignis*, and to the value it might have for hybridizing. The species in question was discovered in 1843 in the State of Vera Cruz, Mexico. It is found in considerable quantities about midway down the flanks of Mount Orizaba and especially near Chiapas. It is a rapid grower, attaining a height of 60 to 80 feet; its bearing is erect and it sends out large branches at the height of 30 or 40 feet from the ground. Its acorns are suitable as food for stock, and very large, usually two inches in diameter and sometimes two and a half. Their weight is 50 to 60 grams each.

In view of its habitat the tree is probably unsuited to a temperate climate, but Dr. Purpus, who has explored its home, thinks that it could be raised in Florida, Cuba, Porto Rico, etc. The office of Foreign Seed and Plant Introduction of the U. S. Department of Agriculture is now endeavouring to introduce it and experiment it. If it is found to be well adapted, it is possible that native species of oaks could be grafted with it, thus yielding a large crop of acorns. Hybridizing experiments should also be made with some local species with a view to obtaining larger acorns.

Close relatives of *Q. insignis* are *Q. strombocarpa* of the same region and *Q. Skinneri* of Guatemala; the acorns of the latter, however, are presumably bitter or astringent.

1132 - West Indian Boxwood. — SPRAGUE, T. A., and BOODLE, L. A., in *Royal Botanic Gardens, Kew, Bulletin of Miscellaneous Information*, No. 6, pp. 214-219, London, 1914.

By means of specimens of flowering and leafy twigs sent to Kew by the British Consul at Caracas, Venezuela, it has been possible to identify the West Indian or Venezuelan boxwood as *Casearia praecox* Griseb. According to information supplied by the same Consul, West Indian boxwood is a product of the district of Maracaibo only, whence all that exported from other ports is originally shipped.

Boxwood is a yellowish hardwood, used mostly for turning. It is cut into pieces about 6 ft. long and from 4 to 8 inches thick. The best time for cutting the wood is from December to June.

Casearia praecox Griseb. had hitherto been recorded only from Cuba; it has, however, been collected also in the district of Santa Marta, Colombia, but under another name. The three forms (Cuban, Venezuelan and Colombian) differ so slightly in their characters and in the structure of their wood, that they may be considered as varieties belonging to the same species.

There are also other species of *Casearia* which yield useful wood.

1133 — **Experiments on the Grazing of Woodlands.** — ZEDERBAUER, E., in *Mitteilungen aus dem forstlichen Versuchswesen Oesterreichs*, Part XXXVIII, pp. 78-83. Vienna, 1914.

By ministerial decree of March 30, 1888, the Royal Institute of Experimental Forestry established a scheme of experiments on the influence of pasturage on woods, planned to ascertain: *a*) the losses of intermediate and direct products caused by pasturage in 1) plantations of spruce, 2) natural growths of spruce; *b*) the nature and extent of the damage caused by the grazing and trampling of animals; *c*) the measures to be taken to prevent damage to the wood, 1) of young trees transplanted and grown from seed, 2) of 3 and 4 year old trees from seed, 3) of 3 year old trees from seed, isolated, and in groups, 4) of 3 year old trees planted out in ordinary holes and with a small hoed area round them; *d*) the most practical means, apart from fencing and hedging, of preventing damage by live stock, to 1) isolated trees with and without supports, 2) trees in groups with and without supports, 3) plantations without artificial protection.

This scheme of experiments was carried out in State forests and also in private forests. The results are summarised in the following table:

The effect of live stock in plantations with or without protection.

Period	Trees without protection		Trees with protection	
	Number	Height metre	Number	Height metre
<i>a) Plantations with (1) and without (2) enclosure:</i>				
1 { May 1894	100	0.16	100	0.17
{ September 1909	12	1.55	61	1.62
2 { May 1893	100	0.25-0.30	100	0.25-0.35
{ October 1899	45	0.5-0.7	63	0.7-1.0
<i>b) Trees not transplanted and transplanted:</i>				
June 1900	100	—	100	—
September 1911	14	0.81	21	0.61
<i>c) Trees with (1) and without (2) supports:</i>				
1 { May 1894	100	—	100	—
{ September 1909	2.8	1.30	71	1.44
2 { June 1895	100	—	100	—
{ September 1911	13	0.77	38	1.15

These results show that: 1) spruce plantations enclosed or with supports made a stronger growth than those without this protection; 2) enclosed spruce plantations at 10 to 20 years contained about two-thirds

(61-63 per cent) of the original plants, whilst plantations without enclosure had only 12 to 45 per cent; 3) 20-year plantations of spruces protected by supports contain 38 to 71 per cent of the original trees, as against 3 to 13 per cent in plantations without supports; 4) 16-year stands of untransplanted spruces are less resistant to the movements of live stock than those of transplanted trees, while the differences in height are very slight; 5) the expenditure incurred in enclosing or providing supports appears to be justifiable from a forestry as well as financial point of view. Protection by means of supports is also an advantage to pasturage.

LIVE STOCK AND BREEDING.

1134 - The Hygienic Importance of Acid-Rennet Bacteria in the Udders of Cows. — GORINI, COSTANTINO (Communication to the VI International Dairy Congress, Berne, June 1914), in *La Clinica veterinaria, Rassegna di Polizia sanitaria e di Igiene*, XXXVII Year, No. 17, pp. 47-51. Milan, September 1914.

HYGIENE

In 1901 the writer showed the presence in the udders of cows, of acid-rennet producing bacteria (cocci causing coagulation by means of acid and rennet) which are generally found in the lactiferous ducts. Later he found some very small bacillus forms, which he called *Bacillus minimus mammarum*.

These acid-rennet bacteria are capable of causing the premature coagulation of milk, *i. e.* before the normal acidity has developed, even immediately it is drawn from the udder and before external contamination.

They develop exceptionally in the lactiferous ducts, being probably favoured by the milk remaining in them after milking, and they cause inflammatory conditions of the udder or other complications. This inflammation differs from mastitis due to pyogenic or specific germs and usually disappears spontaneously, though it is liable to affect the quality and quantity of the milk.

The changes in the milk due to these organisms are very different from those caused by other bacteria and cannot be detected either by acidometric or by alcoholic methods, by boiling or by the reductase tests, etc. They are detected by zymoscopic or fermentation tests, which are also of great importance in judging the cheese-making value of a sample of milk and in detecting abnormal conditions of the udder.

The following practical conclusions may be drawn from these results:

- 1) To prevent the abnormal development of the acid-rennet microflora in the udder it is advisable to ensure that the cow is milked dry so as to empty completely the lactiferous ducts.

- 2) In zymoscopic testing of milk, the type of coagulum produced by the bacteria may be used as a guide by both cheese-maker and veterinary surgeon for indicating faulty milking and abnormal conditions of

the udder, which are as important to the health of the animal as to the quality of the dairy products(1).

1135 - **Poisoning by *Sorghum halepense*** (2). — *Royal Botanic Gardens, Kew, Bulletin of Miscellaneous Information*, No. 6, pp. 229-230. London, 1914.

Sorghum halepense is, after rice, probably the commonest food and fodder plant in India, besides being much used elsewhere; yet the constituents which are liable to exert a poisonous action are not well understood. It has therefore been deemed desirable to publish a note dealing with the matter.

In 1902 DUNSTAN and HENRY isolated a glucoside, which they called dhurrin, from the leaves of the great millet (*Sorghum vulgare*). This substance, on hydrolysis with hot hydrochloric acid or the enzyme emulsin, splits into prussic acid, parahydroxybenzaldehyde and dextrose. The enzyme emulsin is present in the parts of the plant containing the glucoside. *Sorghum halepense* Pers. (*Andropogon halepense* Brot.) is considered by Hackel to be a variety of *S. vulgare* Pers. (*Andropogon Sorghum* Brot.) and there is little doubt that dhurrin is found in it as well as in the typical plant. The cases of poisoning observed are thus to be attributed to prussic acid produced by the hydrolysis of dhurrin in the stomachs of animals.

An examination of the numerous records of cases in which *Sorghum* was used as fodder, establishes two important facts: Firstly, the young vegetative parts of the plant are the most dangerous to stock, the mature plant being nearly or quite harmless; analyses of old plants have shown that little or no cyanogenetic substance was present. Secondly, the poisonous effect of the grass is enhanced in times of drought. One writer states that the grass is dangerous only in the green state and that when it is cut and dried and used for fodder it has no injurious effect. This may be due to the destruction of the glucoside or the emulsin or both, but it is possible that the grass was not cut till near maturity, that is after the disappearance of the glucoside.

1136 - **The Modifications produced in the Anthrax Bacterium by Means of Ultra-Violet Rays.** — Mme. VICTOR HENRI, in *Comptes Rendus hebdomadaires de l'Académie des Sciences*, Vol. 158, No. 14, pp. 1032-1035 + 12 figs.; Vol. 159, No. 4, pp. 346-348 + 6 figs. Paris, April 6 and July 27, 1914.

It is well known that ultra-violet rays cause the death of micro-organisms. M. and Mme. VICTOR HENRI have demonstrated that the abiotic effect of these rays is due to chemical reactions taking place in certain molecular aggregations which are to be found in the protoplasm, and especially in the cell nucleus. When the irradiation is weak, either in the case of the numerous micro-organisms studied by M. and Mme. Henri or in that of the developing *Ascaris* eggs studied by FAURÉ-FRÉMIET, a series of more or less

(1) These conclusions, presented at the International Dairy Congress at Berne, June 1914 were adopted by the International Commission, which introduced zymoscopic testing for the study of the veterinary control of milk, in preference to all other tests (reductase, etc.) recommended for the laboratory control of milk. (Ed.).

(2) See also No. 1644, B. Dec. 1912, and No. 694, B. June 1913. (Ed.).

deep changes takes place. The fact that ultra-violet rays only attack certain chemical constituents of the cells, leaving all the rest intact, led the writer to believe that by regulating the irradiation, it would be possible to produce modifications in micro-organisms.

The writer exposed to ultra-violet rays an emulsion of sporogenetic anthrax 24 hours old in quartz tubes revolving round a lamp for 1, 2, 3, 5, 10, 20 and 40 minutes respectively, and then sowed 1 cc. on gelose and 1 cc. in broth. This treatment killed the greater number of the microbes, but some remained alive and capable of multiplying. A large number of the latter presented a normal aspect, but some colonies differed markedly. From these colonies, the writer has isolated a series of new forms distinct from normal anthrax in morphological, biochemical and biological characters. The character which is least stable under the action of the ultra-violet rays seems to be the uniting to form filaments. Further, the shape of the bacteria was changed (all forms being obtained, from bacilli to cocci), as well as their size (they became $\frac{1}{2}$ or $\frac{1}{3}$ the normal thickness), their sensibility to Gram's reagent (five forms being obtained which gave no reaction), and their pigmentation (two forms gave deep yellow cultures).

While the morphological and biochemical modifications produced in the cultures of bacteria grown in different media, *e. g.* in a medium containing sugar, are unstable and revert to the normal form on being transplanted to a normal nutritive medium, the morphological and biochemical modifications due to exposure to ultra-violet rays are distinguished by their great stability in successive artificial cultures.

On inoculating a guinea-pig with the modified form, the writer obtained in two cases from cultures of the blood from the spleen and liver, colonies with the characters of the normal anthrax bacteria. He therefore concludes that by passing into an animal organism the more modified, yellow, slender, Gram-negative form, which forms no spores, does not liquefy gelatine and has lost most of its virulence, can return almost to the primitive anthrax type.

1137 - **Pyroplasmosis in Cattle in Hungary in 1913: Means of Control.** — WOLLÁK, KÁROLY, in *Allatorvosok Lapok*, Year XXXVII, No. 33, pp. 387-389. Budapest, August 15, 1914.

In Hungary haemoglobinuria in cattle is relatively rare and seems to be restricted to the wooded regions of the North-East (1). Of late years, however, this disease has also appeared in the country on the left bank of the Tisza, where it sometimes takes a virulent form.

In 1913 pyroplasmosis appeared for the first time on May 20, in the commune of Hajduhadház (Hajdu county), and raged in a herd of 137 head of cattle which were grazing on some slightly elevated ground covered with oaks and robinias.

The writer describes the evolution of the disease and classes the symptoms observed into four groups according to the organs most affected. On the bodies of the diseased animals, the greatest number of ticks was found

(1) See No. 353, *B.* March 1914.

(Ed.)

at the end of May, whilst towards the middle of June their number diminished and the disease also began to disappear. As the disease had caused, in a relatively short time, considerable losses (by June 1, 10 animals had perished), in order to prevent its spreading, the writer subjected the herd to examination and then to treatment. Of the remaining 127 head, 30 were still affected and 97 were apparently healthy. The herd was removed from the infected spot and the 30 affected animals were isolated and kept in a stable; 7 among them were kept as controls and the others were subjected for ten days running to arsenical treatment. They were given every day, in a small ration of bran, the following mixture: 1 gm. of powdered arsenious acid; 10 gms. of powdered *calamus* root; 10 gms. of sulphate of iron. The bodies of the diseased animals were freed from ticks and the skin was washed with a 5 per cent creoline solution. Already after the first and second treatment it was observed that the animals regained their appetite; their urine presented its normal colour, and the weight of the animals perceptibly increased. The 23 animals under treatment were all cured, whilst among the 7 controls, 1 died and 2 had to be slaughtered.

In the herd which had been removed from the infected spot, 25 animals fell ill. In two cows the disease took a rather mild form, but with symptoms that the writer had never before observed in the symptomatology of pyroplasmosis. During the examination one of the cows used to let itself fall on its knees and remained a length of time in that position, while the other crossed its front legs; the disease appeared in these two cases under nervous forms, and as the urine emitted was not red but of a deep yellow, the diagnosis was rendered more difficult. Here also arsenic showed its beneficial effects. The useful action of arsenic observed in destroying parasitical protozoa (*Spirochaetes*, *Trypanosomes*) leads the writer to hope that this substance, in the form of powder, will be a valuable means of controlling pyroplasmosis, especially as arsenic acts favourably on metabolism and on the increase of weight. Further experiments will decide whether the use of the new arsenical preparations, (salvarsan and neosalvarsan) can be practically recommended for cattle attacked by pyroplasmosis.

1138 - Preventive Inoculations against Sheep and Swine Pox. — PÉCSI, DANI, in *Allatorvosi Lapok*, Year XXXVII, Nos. 30, 31, 32, pp. 357-359, 369-370, 381-382 + 2 figs Budapest, July 25, August 1 and 8, 1914.

The present is a study intended to afford Hungarian farmers information on sheep and swine pox (1) and on the means of controlling this disease. The writer mentions the works of numerous investigators who have sought to find a harmless virus which would ensure the active immunity of sheep. CHAUMIERS, VOIGT and others again have endeavoured to attenuate the activity of the variolous virus by passing it through an animal organism, so as to obtain a curative serum.

The writer, who has studied the question for the last 29 years, relates

his experiments during 1913, made with virus attenuated by passing through calves, which have not given a definite result because calf-pox inoculated into sheep gave only 50 per cent. of immunity.

The study is completed by a report of a series of remarkable experiments by BRIDRÉ and BOQUET (1). Encouraged by the results of BESREDEKA'S (2) discovery on the properties of sensibilised virus, they proceeded, by the application of this discovery, to modify the variolous virus in its activity by a contact of a certain duration with anti-variolous serum, or in other words to transform it, by sensibilising it, into vaccine. The experiments have had considerable results. The animals that were vaccinated with the sensibilised virus did not contract the disease and acquired in two to six days after the injection an absolute immunity. This immunity is very constant, and the vaccinated sheep did not prove at all dangerous to the untreated animals with which they were left in permanent contact. The injection must be made under the skin of the thorax behind the elbow; it causes generally, after four or six days, the formation of an oedema of variable size attaining sometimes that of a hen's egg, which is resorbed after a few days, leaving a hard spot which gradually disappears. The local reaction following on the subcutaneous injection of sensibilised virus varies in intensity according to the age of the animals. It is very slight in sucklings, more marked in lambs eight to ten months old and strongest in grown up sheep. Even when the local reaction fails, vaccination produces active immunity. In some especially sensitive animals, four or five days after the injection an increase of temperature sets in, which, however, is independent of the degree of local reactions. Vaccination does not cause any trouble in the physiological condition of the animals. Ewes in lamb or during lactation may be vaccinated without any danger of abortion or decrease of milk yield. Vaccination practised on sheep during the period of incubation of variola, has no unfavourable effect on the evolution of the disease. Anti-pox vaccination is thus applicable in contaminated surroundings, to all apparently healthy subjects. The really sound animals will acquire immunity and those that are already infected will undergo the disease as usual. In 1913 in Algeria 1 245 000 sheep were treated with this serum and not a single accident occurred.

MM. BRIDRÉ and BOQUET placed at the disposal of the writer a small quantity of sensibilised virus with which to experiment upon Hungarian sheep. The tests were made on ten lambs from four to six months old, of which two were kept as controls and the rest vaccinated as follows: two received the prescribed dose (0.2 cc); four were given half the dose and two a quarter; five days after vaccination all the vaccinated animals showed, at the spot where the injection had been made, oedemae of different sizes. In one of the animals the temperature curve showed a maximum of 41.8° C.,

(1) Vaccination contre la clavelée par virus sensibilisé. — *Annales de l'Institut Pasteur*, No. 10, October 1913.

(2) De la vaccination par virus sensibilisé. — *Bull. de l'Institut Pasteur*, 1910, p. 241. 1912, p. 529.

whilst in the others it did not attain 41°C. The quantity of lymph used had no influence on the effect of the vaccination. The controls did not show any change, their temperature remaining unvaried at 39° C. Eight days after vaccination all the animals were infected with pox; five days after infection the two controls presented, at the infected spot, an inflammation which developed after four days into a pustule the size of a pigeon's egg, while the animals vaccinated with the sensibilised virus remained perfectly immune. The spots caused by the infection had disappeared.

Sheep breeding has greatly benefited by the researches of M. M. BRIDRÉ and BOQUER, who have solved the vaccination problem: namely *they have conferred an active, efficient and lasting immunity to sheep against sheep pox, by the inoculation of virus which is harmless to the animals inoculated, and incapable of producing contagious lesions.*

The writer warmly recommends the use of antipox serum, thanks to which sheep breeding in Hungary will be gradually freed from its greatest enemy.

1139 — Studies on Fowl Cholera: The Inheritance in Rabbits of Immunity to Infection with the Bacterium of Fowl Cholera. — HADLEY, PHILIP B., in *Agricultural Experiment Station of the Rhode Island State College, Bulletin* 157, pp. 285-307. Kingston, N. Y., April 1914.

The present paper is the writer's third contribution to the study of fowl cholera. In the first ("Fowl Cholera and Methods of Combating it", *Bulletin* 144, *Agricultural Experiment Station of the Rhode Island State College*) the writer announces the occurrence of the disease, — already known in Europe more than a century ago, — in the United States, especially in New England. Fowl cholera, caused by *Bacillus bipolaris septicus*, has been controlled by inoculations with serum, which, however, have not given uniform results. The writer obtained good preventive results by means of subcutaneous injections with from two to four cc. of 5 per cent carbolic acid, repeated daily for a week.

In the second work, prepared with the collaboration of ELIZABETH E. AMRSON ("A Biological Study of Eleven Pathogenic Organisms from Cholera-like Diseases in Poultry", *ibid.*, *Bulletin* No. 146) the writers set forth the results of a biological study of eleven pathogenic organisms obtained from cholera-like diseases in poultry. The real fowl cholera caused by *Bact. bipolaris septicus* is endemic in New England and probably in all the central part of the Western States of the Union. There are, however, other diseases resembling fowl cholera caused by bacteria of the para-colon, para-typhoid or influenza groups.

The writers studied ten cultures of *Bact. bipolaris septicus* obtained from localities very distant from each other, and they found that the bacteria were in all cases identical. The virulence of the cultures examined varied considerably: the minimum dose of 48 hours' broth culture fatal to a fowl varied from 10 cc. to a millionth of a cubic μ , and the minimum dose fatal to a rabbit from 10 cc. to one hundred millionth of a cubic μ . It was demonstrated that less than 50 bacteria, and probably only 4, injected

into the muscles of the chest were sufficient to cause infection. One is led to believe that in infected animals an immediate paralysis of the functions of the phagocytes takes place, whence the terrible infectiousness under natural conditions. The bacterium resists four months' esiccation (the maximum limit is still undetermined); it is killed by heating to 63° C for 15 minutes; and it has very little resistance to carbolic acid and to acids in general.

A very virulent culture finds resistance in a susceptible animal when the latter has been previously inoculated with a homologous non-virulent culture. In rabbits, an artificial resistance to 10 billion times the minimum fatal dose of a highly virulent culture has been produced by a single strong dose: 3 cc. of the homologous culture. Only homologous cultures produced such resistance in rabbits.

The third work is a continuation of the preceding ones and deals with the nature of the immunity in rabbits and the production of a corresponding active immunity in fowls.

The writer gives a historical resumé of the inherited resistance to infectious diseases, from which he concludes: that immunity to certain infectious diseases, together with other phenomena dependent upon humoral factors of the blood, is transmissible from immune mothers to their offspring; that the immunity thus transmitted and acquired, is due in reality to the transmission of antibodies, is not inherited and transmitted by the male and is not present in the second generation; that inherited resistance is of short duration, but that in some cases it can be transformed into active resistance by inoculating the young animals with a virulent culture.

The cultures used in this study were the same as those employed in earlier investigations; they can be placed in two groups: the immunizing group and the infecting group. There has been found no morphological or cultural means of differentiating between the organisms of these two groups of cultures; the biological test alone serves to distinguish them. For the present research an immunizing (avirulent) culture was used. From his experimental results the writer concludes:

Female rabbits immunized with an avirulent culture of fowl cholera bacterium are able to transmit to their offspring a high degree of resistance to virulent cultures. Some immune mothers are able to produce such immune offspring for at least more than two years after the date of immunization. Immunity is not transmitted by the immune male. The resistance in the offspring is not permanent, enduring for not more than forty days. This inherited passive resistance can be transformed into a durable, active resistance by inoculating the young animals, some time within the first forty days of life, with a virulent culture.

ANATOMY
AND
PHYSIOLOGY

1140 — On Ovariectomy in Sows; with Observations on the Mammary Glands and the Internal Genital Organs (1). — MACKENZIE, K. J. J.; MARSHALL, F. H. A., and HAMMOND, J. (School of Agriculture, Cambridge) in *The Journal of Agricultural Science*, Vol. IV, pp. 410-420; Vol. V, pp. 418-423; and Vol. VI, Part 2, pp. 182-186. Cambridge, 1912, 1913 and 1914.

It is commonly found that the flesh of pigs killed "on heat" produces inferior bacon and pork, and the occurrence of animals in this condition in the slaughterhouses causes considerable losses to various bacon-curing firms. Of recent years, notwithstanding these losses to bacon manufacturers and pork butchers, the practice of spaying has been on the decline and in many pig-raising districts has largely disappeared, the reason being that pigs are now made ready for the butcher before they are nine months old and are consequently less affected while in the feeders' hands by the neglect of the operation than when they are killed at a more advanced age, so that breeders hesitate to expose them to the slight risk of the operation. Moreover, many feeders aver that they find some spayed sows which behave like unoperated animals and consequently that the risk and slight expense are futile.

The writers examined three cases in which spayed sows were said to have behaved as if unspayed and found that in all three cases the operation had been incompletely performed, part of an ovary having been left behind in the body cavity and causing the undesirable symptoms in the bacon pig, which consist chiefly in a greatly increased vascularisation in the mammary region and consequent depreciation of a valuable part of the pig. It would therefore appear that the objection to spaying on the grounds of its ineffectiveness put forward by feeders is without foundation, cases of failure being rather due to imperfect operations.

When examining carcasses in order to discard those of pigs killed on heat, bacon curers have been in the habit of regarding the presence of black melanic pigment in the deeper layers of the mammary tissues of coloured sows as due to extravasated blood and therefore a sign that the animal had been killed when on heat and that its carcass could only be used to produce bacon of an inferior grade. The writers examined a very large number of pigmented and unpigmented carcasses of both sexes and in various conditions with regard to their sexual organs; they obtained no evidence that the presence of the pigment was in any way associated with the sexual condition of the animal, but found that the pigment occurs only in certain dark-coloured animals. The remedy for this defect is to breed from animals in which the pigment is absent.

1141 — On Some Factors Controlling Fertility in Domestic Animals. — HAMMOND, JOHN, in *The Journal of Agricultural Science*, Vol. VI, Part 3, pp. 263-277 + 2 plates. London, September 1914.

The fertility of domestic animals is a subject of ever increasing importance, for with the improvement of the breeds of live stock there has come in many cases lessened fertility and often sterility. Thus, in Great

Britain the Royal Commission on horse breeding found that about 40 per cent of the mares selected for breeding failed to produce foals.

PEARL has recently shown that the variation in fecundity (eggs produced) in various breeds of the common fowl is not anatomical; that a fertile strain of fowls does not necessarily contain more oocytes in the ovary than an infertile strain. He concluded that the fecundity of fowls depends on a physiological factor causing the oocytes to develop and grow. In mammals it is known that many oocytes atrophy at some stage of their development, but this has not yet been described in the common fowl. HEAPE and MARSHALL, who investigated the fertility of sheep, came to the conclusion that several factors influenced the number of ova shed during the heat period: among others, service early in the breeding season and the practice of "flushing", which seem to favour the ripening of the oocytes and prevent atrophy of the follicles. Nevertheless, some facts could not be explained as a simple result of the number of follicles which ripened, for instance the fact that in-breeding reduces fecundity while out crossing increases it, as has been observed by HEAPE in sheep, by DARWIN in pigs, by RITZEMA-BOS in rats, and by VON GUAITA in mice.

Since ovulation occurs spontaneously in the pig and is not influenced by copulation, the diminution of fertility on in-breeding must be due to other causes than the number of follicles rupturing at the heat periods. HEAPE suggested that in sheep the decreased fertility when in-bred might be due to some sort of abortion. STEPHENSON attributed many cases of sterility to the male, owing to a want of vitality, varying in degree, in the spermatozoa, which prevents the ovum or foetus reaching maturity and thus causes abortion.

The writer has endeavoured to determine the factors controlling the number of young produced at birth by counting the number of *corpora lutea* and foetuses in pregnant animals at various stages of gestation. The animals observed were rabbits, pigs and a bitch. The writer divides the factors controlling fertility into two groups:

1. Factors controlling the number of ova shed (fecundity, of PEARL).

2. Factors controlling the number of embryos which develop to reach maturity.

1. *Factors controlling the number of ova shed.*

In all probability it is as regards this factor that species and factors vary in the matter of fertility. It seems to be a complicated physiological factor which can be modified to a certain extent by improving the nutrition of the ovary. PEARL observed that the greatest egg production in fowls is in the first year; in general, fertility increases with age up to a certain limit, after which it falls gradually. It is well known that the number of offspring produced by a young animal breeding for the first time is below normal. MINOT has observed this fact with guinea-pigs, P. G. BAILEY with rabbits, WALLACE with sows. The writer has observed in 18 young sows that the number of *corpora lutea* varied from 11 to 19 and averaged 14.3 ± 0.39 , whilst in 9 old sows it ranged from 13 to 24 and averaged

19.77 \pm 1.26. It appears therefore that the lower fertility of young sows is due to a smaller number of ova being shed.

2. *Factors controlling the number of embryos which develop to reach maturity.* — The writer counted the *corpora lutea* in the ovaries and the number of foetuses in the uterus of pregnant sows, rabbits and a bitch, and found that the average number of ova shed at a heat is larger than that of the foetuses. In sows the number of ova was twenty, while the average litter of pigs is about twelve. In American breeds it appears to be even less: in Duroc Jerseys 9, and in Poland-Chinas 7.5. In rabbits the average number of *corpora lutea* was found to vary from 8.4 to 11, and the corresponding number of foetuses from 6.4 to 8.1. Of some of the ova shed at the time of conception no trace can be found in the uterus; it is supposed they may be lost by wandering into the body cavity instead of being caught by the Fallopian tubes. This, however, could not occur in the Carnivora, where the fimbriated end of the Fallopian tube completely surrounds the ovary. In the bitch examined by the writer the number of foetuses and *corpora lutea* were the same, namely five.

There is also the possibility that some of the ova may have escaped fertilization; or rather that they have been atrophized at a very early stage of development of the embryo, so as to leave no trace of their implantation.

Other ova shed from the ovary, although developing to a certain extent, never come to maturity and atrophy in the uterus.

The writer has found in sows and rabbits, and other observers have found in cows, sheep, hamsters and ferrets, that the pregnant uterus often contains, besides the normally developed foetuses, a few smaller ones in different degrees of development and in various stages of degeneration. Of seven sows observed by the writer, four contained atrophic foetuses with an average of 2.1 for the seven sows. Of 38 rabbits, 11 contained atrophic foetuses.

In animals bearing many young at birth this atrophy of the fertilized ovum is not very important economically, since, as a rule, many more ova are shed than would furnish foetuses to occupy the teats of the mammary gland. In animals producing only one or two young at a birth (mares and cows), however, the matter becomes one of great importance, for in these animals cases of complete sterility are frequent.

The cause of atrophic foetuses is not bacterial, since normal and atrophied foetuses are often found side by side; besides, the writer in his search for bacteria in the atrophic foetuses and in their membranes obtained only negative results.

The nutrition of the pregnant mother cannot be the cause of atrophy, though in many cases it affects the size and vigour of the new-born. From measurements made by the writer it appears that on the whole the longer the foetal membranes in pigs the larger the foetus. No connection has been found to exist (in pigs and rabbits) between the weight of the foetus and its position in the uterus; consequently competitive nutrition has very little effect in determining the size of the foetus. Fraenkel has shown that eth nutrition of the foetus is more especially under the control of the *corpus luteum*.

From an examination of the works of several investigators, it seems possible that the atrophy is due to the low vitality of the foetus owing to constitutional loss of vigour of either parent at the time of mating, or to insufficient vitality in the spermatozoa, or to domestication (the writer observed that in wild rabbits atrophic foetuses are much rarer than in domestic rabbits). It seems that the effect of domestication on these animals is to increase the number of ova shed and at the same time to diminish the proportion of those which develop.

The writer does not arrive at any definitive conclusion on the cause of the atrophy, and the several possibilities suggested are still under investigation.

1142 - Research on the Transformation of Energy in the Domestic Fowl. — GERHARTZ, HEINRICH, in *Landwirtschaftliche Jahrbücher*, Vol. 46, Part 5, pp. 797-814. Berlin, July 14, 1914.

The most important investigations hitherto made by VÖLTZ, LEHMANN, PARATSCHUCK, RICHET, REGNAULT-REISET and others, on the transformation of energy in the domestic fowl, as well as in birds in general, are now no longer sufficient, as they do not correspond to modern demands upon the technique of observation and do not give due weight to the biological activity of the animals. The writer, with the assistance of the Prussian Ministry of Agriculture, undertook several experiments on this subject. They were carried out with an improved system of Regnault-Reseit's apparatus, in which the bird was in a state of repose throughout almost all the experiments and could be observed without being disturbed. The writer experimented upon fasting birds and birds that had been fed. In the first case the bird was not given any food during the 13 hours which preceded its being put into the respiratory apparatus. In the second case the bird usually ate its ration during the preliminary experiment. The ration was calculated to keep the weight of the body constant. When the bird was not in the respiratory apparatus it was kept in a roomy cage.

The object of the first experiments was to observe the quantity of energy transformed in the fowl when it was in a state of absolute repose and consumed only so much matter as was necessary to keep up its physiological activity. This transformation of energy is called by the writer the "minimum" or "upkeep transformation", and it amounted to 58.37 calories for the normal fasting fowl and 62.15 calories for the same bird that had been fed, per day and per unit of surface (1000 square centimetres). In the brooding hen of the same breed after feeding, the corresponding figure was 71.78 calories. On comparing these values with those of Zuntz for dogs (75.1) and for horses (94.8), it appears that fowls in a state of absolute repose have not a relatively high transformation of energy, but a relatively low one. An abnormally high transformation in birds is thus quite out of the question.

The next experiments were aimed at ascertaining how, and to what extent, the organs of reproduction and their functions acted on the minimum transformation. With this object experiments were made during the moulting and the brooding periods. They showed that during the moulting

period the transformation was slightly increased, namely by 5.2 per cent, while the brooding period did not cause any change.

In a third series of experiments the writer endeavoured to determine whether the laying period, exclusive of the amount of energy required for the formation of the egg, had a specific action on the transformation. With this aim experiments were made before and after the laying period. If there was a specific surplus of energy beyond that required for the formation of the egg, it ought to be noticeable in the period of transition. The experiments showed that the transformation of energy went on increasing even after the period of egg-laying, which can only be explained by admitting a specific effect of the period of laying on the transformation of energy. Eight days before laying the first egg, as another experiment showed, this effect was not yet noticeable.

A last series of experiments was devoted to determining the influence of the function of egg-laying on the transformation of energy in the hen. With this object several tests were made. Of these the first group led to the following results. The period of egg-laying caused an increase of 70.1 calories in the transformation of energy, or 78 per cent per unit of surface per day. Each day 43.9 calories, or 26.2 per unit of surface, were employed for the formation of the egg. Admitting that the period of egg-laying itself, without considering the outlay of energy directly caused by the formation and expulsion of the egg, increases the transformation of energy by about 35 per cent (experimental results of successive periods), there would always remain $78 \text{ per cent} - 35 \text{ per cent} = 43 \text{ per cent}$ for the formation of the egg and egg-laying proper.

In the second group of experiments on the egg-laying period, the results differed somewhat, for instead of the 26.2 calories per day and per unit of surface, 24.8 calories were utilized in the formation of the egg.

The figures obtained in these investigations are interesting also from another point of view. If, as has been stated above, 26.2 calories are consumed for the formation of the egg, 10.8 correspond to the protein and 15.4 to the fat. The fixation of these two substances requires, however, different contributions of energy. Admitting, with KLEIN and VON DER HEIDE, that for the formation of 1 gram of protein 7.25 calories are required, and for 1 gram of fat 2.5 calories, the fixation of the protein would have required 13.8 calories and that of the fat 4.1, thus altogether 17.9. But the period of egg-laying caused an increase of 70.1 calories in the transformation of energy. There remains therefore a surplus of $70.1 - 17.9 = 52.2$ calories. Taking the specific influence of the laying period at 24.5 calories (that is 35 per cent of 70.1), there remains a difference of energy of $52.2 - 24.5 = 27.7$ calories, corresponding especially to the formation of the egg above the expense of energy required for the formation of flesh. The formation of the egg in the hen is thus accompanied by a considerable expenditure of energy.

1143 - **The Preparation of Ensilage.** — SAMARANI, FRANCO, in *Bollettino del Ministero di Agricoltura, Industria e Commercio*, Year 13, Nos. 8-12, pp. 87-103. Rome, August-December, 1913.

FEEDS
AND FEEDING

The results of the experiments carried out for many years by the writer for the purpose of discovering the best method of preparing ensilage in ordinary silos have shown that during the first few days after the grass has been put in, two typical and different fermentation processes take place at the expense of the sugar and of the cell-sap — an acetic fermentation and a lactic fermentation.

The first is an intracellular process, through which the sugars of the cell substance are transformed, as a result of the vital activities of the cell in a relatively warm place (silo) where there is an almost complete absence of oxygen, into alcohol and carbonic acid. Later, as a result of chemical or physiological, but certainly not bacterial, action the alcohol is transformed into acetic acid. The second process is an ordinary lactic acid fermentation, due to the action of bacilli and cocci such as are found in milk and milk products. Of the total free acid content of normal acid silage, on an average 70 per cent is acetic acid, up to 20 per cent lactic acid, and, roughly speaking, 10 per cent butyric acid.

The predominance of the acetic acid is chiefly due to the fact that the temperature of the silo rises to 40-60° C, which is particularly favourable to intracellular fermentation. If, however, the lactic fermentation has free sugar at its disposal, it can, owing to its power of acting directly upon the latter, produce more acid than the acetic fermentation, which can only transform sugar into acid indirectly. When in the acid ensilage sufficient lactic and acetic acids have been produced, which takes place ten days after the filling and pressing down of the silo, no further bacterial fermentation goes on. If sufficient acidity is not soon attained by the two fermentation processes, a putrefactive fermentation sets up, with formation of ammonia, butyric acid and other malodorous compounds. Unsuitable fermentation, from the experience of the writer, is best prevented by the addition to the silage of a dilute solution of milk sugar.

From these observations, the conclusion can be drawn that in order to succeed in making ensilage, it is above all necessary to avoid overheating the fodder, in order to limit the acetic fermentation and thus to leave the decomposition of the sugar chiefly to the lactic fermentation process. This end can best be attained by providing the silo with mechanical means of applying pressure. The experiments of the writer in this direction showed that mechanical pressure is best applied immediately after the required amount of fodder has been put in, so as by this means to free the silo as much as possible from air. When the interior of the silo is once free of air, the temperature rises with difficulty and the lactic fermentation is promoted at the expense of the acetic fermentation.

According to observations made by the writer, silos with mechanical presses yield a fodder with 70 per cent lactic acid and 20 per cent acetic acid, while the proportion is just reversed in the product of an ordinary silo. Further, they have the additional advantage of producing ensilage containing less free acid and which consequently smells less strongly.

In conclusion, the writer gives some information respecting an ensilage experiment with beet slices straight from the sugar factory. He found that in order to obtain a satisfactory product, it was necessary to remove all the air from the silo. This was of course best effected by heavy pressure.

In order to promote lactic fermentation, Sig. Samarani advises, as in the treatment of grass, the addition to the silage of a solution of milk sugar.

1144 - The Forage Value of Redshank (*Polygonum lapathifolium*). —

STÖRME and KLEIN, in *Deutsche Landwirtschaftliche Presse*, Year 41, No. 80, p. 890. Berlin, October 7, 1914.

Redshank (*Polygonum lapathifolium*) was used by many farmers as fodder in Germany during 1914. Its chemical composition is, according to a recent analysis made at the Köslin Experiment Station, as follows :

Water	71.74 per cent.
Dry matter :	
Ash	2.29 per cent.
Crude fat	0.69 "
Crude protein	3.07 "
Crude fibre	8.08 "
Nitrogen-free extract	14.03 "
	28.16 "
	99.90 per cent.

The digestible substances are :

Crude protein	1.72 per cent.
Pure protein	1.25 "
Fat	0.35 "
Crude fibre	4.70 "
Carbohydrates	9.35 "
	17.37 per cent.

According to the above analysis, the food value of redshank is equal to that of pasture grasses such as rye-grass and cocksfoot.

All practical farmers agree in stating that redshank has given complete satisfaction as fodder and that it has not caused the slightest injury to the health of the animals. As food for milch-cows it has also been useful. The writer believes that in years of scarcity of forage it will prove a welcome addition to the food supply.

1145 - The Influence of Temperature on the Microflora of Hay: Lactic and Butyric Hays. — GORINI, C., in *Rendiconti della R. Accademia dei Lincei*, Vol. XXIII, Series V, Part 1, No. 12. Rome, 1914.

Applying the methods of silo research (1) to hay, it has been possible to determine a main difference between normal and abnormal hay. Those hays are to be called normal which have not undergone abnormal maceration or fermentation, nor become mouldy, scorched or damaged. Normal hays are divided into normal lactic and butyric hays according to the nature of the predominating fermentation.

(1) See No. 541, B. June 1914.

(Ed.).

The writer submitted the same hay stack during its various stages of fermentation to zymoscopic and bacteriological examination. He found that during the first 3 to 5 days of fermentation, with a temperature of 50-55° C., the hay was prevailingly lactic, whilst as the temperature gradually rose to 60-65° C. and beyond, the mass tended to become more butyric, as is unfortunately often the case in ordinary stacks.

The results confirm those obtained in the case of silos:

1) Normal hay may be classified as lactic or butyric according to the predominating microflora.

2) The nature of the microflora is in direct relation to the temperature of fermentation.

3) Most hay, as in the case of ordinary silage, is of the butyric type and is consequently less favourable to the intestinal functions of the live stock and to the sanitary condition of the milk and its products.

4) To obtain lactic hay, care should be taken in stacking it to expel as much air as possible and to maintain a temperature of about 50° C.

These conclusions show the importance of zymoscopic-bacteriological control of fodder in order to estimate its value as forage from a health and dairy point of view. Thus a normal hay may as a result of organoleptic, chemical or simple microscopic examination be declared healthy and yet contain a microflora dangerous to the intestinal functions and health of stock and consequently to the quality of the milk and dairy products.

1146 - The Food Value of *Stizolobium aterrimum* and *S. pachylobium* Beans. — SHREWSBURY, HERBERT S., in *Bulletin of the Department of Agriculture, Trinidad and Tobago*, Vol. XIII, No. 81, pp. 194-195; and No. 82, pp. 240-241. Port-of-Spain, June and July, 1914.

The seeds of the two species of *Stizolobium* grown on the same estate in Trinidad, in the same seasons, were recently submitted to the Department with a request for information as to their suitability for fodder.

Their nutritive value is shown by the accompanying table; it is very nearly the same for both species, but *S. pachylobium* is somewhat preferable because it has larger seeds and consequently a lesser proportion of teguments and indigestible crude fibre.

Feeding experiments on guinea-pigs showed it to be highly improbable that the beans were toxic in the slightest degree.

On analysis no poisonous glucosides, saponins, fats, alkaloids, vegetable ptomaines or toxalbumins were found. Besides, the beans of *S. pachylobium* have been used as fodder and also for human food without ill effects. It does not appear, however, that *S. aterrimum* has ever been used, in Barbados, as fodder or as human food, while the leaves are said to have poisoned cattle. It is not yet quite certain that *S. aterrimum* is not a synonym for *S. utile* or *Mucuna utilis* of Wallich, which has been cultivated extensively in Mauritius and Tasmania as a table vegetable and as a fodder for cattle.

In the accompanying table the composition of soy beans is also given for comparison. The two *Stizolobium* are inferior in feeding value

to soy beans, but they are somewhat superior to French, Lima or field beans.

	Carbo- hydrates	Proteins	Water	Crude fibre	Ash	Fat	Feeding units
<i>S. aterrimum</i>	44.3	29.8	12.0	6.2	4.2	3.5	127
<i>S. pachylobium</i>	47.2	29.2	11.0	4.1	4.2	4.3	131
<i>Soja hispida</i>	39.2	33.2	10.0	4.4	4.7	17.5	157

1147 — **Statistics of British Feeding Trials and the Starch Equivalent Theory.** — WOOD, T. B., and YULE, UDNY G. (School of Agriculture, Cambridge) in *The Journal of Agricultural Science*, Vol. VI, Part 2, pp. 233-251. Cambridge, May 1914.

Summaries of about 400 feeding trials (200 dealing with oxen and 200 with sheep) were compiled from reports of British experiments carried out down to 1907 and were published in the *Journal of the Highland and Agricultural Society* for 1909-1910. The present paper makes a statistical examination of these summaries for the purpose of investigating the reason why British experimenters, calculating on the basis of Kellner's figures, usually find that the increases produced by various diets are not proportional to the excess of starch equivalent provided by the diets above that required for maintenance.

Swedes were the first to be investigated in this connection, as they represent an article of food used to a much larger extent in Great Britain than on the continent, and it seemed quite possible that Kellner's figures for starch equivalents in roots, which are based on a small number of experiments, are not accurate when roots are used in such large amounts as is usual in British farming. All experiments dealing with the feeding of swedes to oxen were abstracted from the summaries, and, after deducting the food required for maintenance from the other constituents of the diets as far as possible, the results of feeding swedes were obtained in terms of increase as follows :

Corrected weight of swedes in ration above maintenance, per 1000 lbs. live weight per day	Number of experiments	Average live weight increase produced per 1000 lbs. live weight per day	Probable error of average
lbs.		lbs.	
40 to 60	3	1.46	—
60 " 80	4	1.73	—
80 " 100	14	1.72	0.082
100 " 120	17	1.83	0.061
120 " 140	13	1.93	0.078
140 " 160	8	1.85	0.048
over 160	3	2.39	—

Now assuming that the increase consists of 67 per cent. of fat and 33 per cent. of water (LAWES and GILBERT) and that 1 gm. of starch equivalent yields 3.76 calories in the animal and 1 gm. of fat 8.8 calories, the following rough approximation to the percentage utilisation is obtained for swedes used in varying quantities above maintenance:

Corrected weight of swedes in ration above maintenance, per 1000 lbs. live weight per day	Percentage utilisation
—	—
lbs.	
50	51
70	43
90	33
110	29
130	26
150	21

The figures receive some support from the fact that Kellner's average figure for percentage utilization is 50 per cent. which is about the same as the utilisation of swedes in the British trials when used in small quantities. They also agree with figures directly determined in the winter of 1913-1914, when two lots of 10 oxen of similar weights were fed on just sufficient cake and chaff to supply maintenance, the one lot receiving in addition 46 lbs. of swedes, the other 138 lbs. In the former case the percentage utilization was 47; in the latter it fell to 32. In the experiments on which Kellner based his starch equivalents, the amounts of food added to the basal ration varied very considerably, yet there is always direct proportionality over a wide range of diet between the excess of food above that required for maintenance and the amount of increase produced, and in all cases approximately 50 per cent. of the excess of food expressed as calories above maintenance requirements was utilized as increase in live weight.

The next step was to recalculate the results of all the experiments given in the above-mentioned summaries in order to determine their percentage utilization. The new results were as follows:

Lbs. starch equivalent above maintenance: oxen per day sheep per week	Percentage utilisation	
	Oxen	Sheep
3 - 4	—	58 ± 5
4 - 5	—	48 ± 5
5 - 6	—	56 ± 3
6 - 7	39 ± 2	48 ± 2
7 - 8	35 ± 2	46 ± 2
8 - 9	34 ± 1	37 ± 2
9 - 10	32 ± 1	37 ± 2
10 - 11	30 ± 2	42 ± 2
11 - 12	26 ± 2	—
12 - 13	24 ± 1	—
13 - 14	21 ± 1	—

These figures agree with those given above for the utilization of swedes: the larger the amount of food above the maintenance ration, the smaller the proportion utilized, yet the figures are comparable with Kellner's at any rate as regards range of diet. The difference between the two sets of results make it clear why British experimenters do not obtain results in their feeding trials which agree with Kellner's starch equivalent theory: Kellner's starch equivalents are based on figures which indicate a direct proportionality between the amount of food consumed above the maintenance ration and the live weight increase produced, while British feeding trials indicate clearly and with certainty that the percentage utilization of food decreases as the diet is increased, each successive increase giving a smaller return in live weight increase than the last.

As a possible explanation of the divergence between Kellner's and British experience, the probable errors of the results were worked out and removed all doubt as to the significance of the differences observed. Another possibility was that whilst Kellner's figures are based on experiments in a respiration chamber, in which the carbon fixed in the form of increased weight was accurately determined by means of a carbon balance, the British results were obtained in ordinary feeding trials in which the utilization is calculated from the increase in live weight by a factor depending on a very small number of experiments carried out at Rothamsted many years ago. This factor may be assumed to give the proportion of fat in the total increase of weight as a lean animal becomes fat, but it may fail to give with accuracy the proportion of fat in successive increases as the animal slowly fattens from the lean condition. There is some evidence to show that the first addition of live weight increase to a lean animal may contain as much as 50 per cent. of water and only 50 per cent. of fat, whilst the last additions of weight to the animals may be almost entirely fat. In the case of the oxen this would increase the lowest utilization with the highest diet from 21 per cent. to 31.5 per cent., which is still significantly below the highest percentage utilization of 39 per cent. and much lower than Kellner's average figure of 50 per cent.

A further reason for divergence might lie in the fact that whilst Kellner's experiments were confined to the measurement of the carbon balance for a short period including the formation of only a few pounds of fat, the period of the British experiments was some four or five months, during which the animals laid on several hundredweights of live weight increase; it is quite possible that there might be a direct proportionality between food and increase in the early stages of fattening whilst the animal is still comparatively lean. Accordingly all the experiments with oxen were classified according to the period of feeding and their percentage utilization was worked out as follows:

Length of experiments in days	Percentage utilization
20 to 80	32
80 " 100	31
100 " 120	33
120 " 180	32

Evidently the length of time of the experiment has on the average no effect on the percentage utilization of food, the reason of this probably being that in some of the shorter experiments animals already half fat were used, and under these circumstances, the length of the experiment is not a measure of the extent to which the fattening process was pushed. The question was therefore attacked by calculating the percentage utilization during the various stages of fattening in a separate series of trials, the detailed data of which were available. The results are given below.

	Percentage utilization
1st month	39
2nd "	34
3rd "	31
4th "	15

The average utilization is very good during the first month and does not fall off much during the second and third months, but in the fourth month the falling-off is very striking indeed. It would therefore appear that whilst Kellner's starch equivalents may give a fairly accurate measure of the amount of fat production to be expected from various foods in the early stages of fattening, they fail to do so in the later stages, because as fattening approaches completion, the law of diminishing returns asserts itself and a given amount of starch equivalent produces less and less fat as time goes on and the animal gets ripe. Kellner's starch equivalents, too, fail when very liberal diets are used, because here the animal very quickly reaches that stage of fatness at which the law of diminishing returns begins to make itself felt.

The writers point out the remarkable variation in efficiency, as fat-producing machines, among animals of the same breed fed under identical conditions and show that the standard deviation under these conditions is 21 per cent. of the live weight increase and the probable error in the increase of one animal 14 per cent. Calculating on this basis, average-sized animals on average rations having a heat value of 25 400 calories would retain from 6 400 cal. to 8 400 cal. in their bodies and give out heat amounting to 19 000 and 17 000 cal. respectively. Examination of the increase of individual oxen shows that, assuming that similar amounts of food are digested, the differences between the amounts of heat evolved are even larger than those indicated above and may reach 25 per cent. between what the farmer would call a good and bad "doer". Investigations are at present in progress at Cambridge on the variation of digestibility according to the individual peculiarities of the animal and the amount of diet, and on the possibility of estimating the rate of heat evolution from animals of known fattening capacity by measuring the difference between their skin temperatures and the temperature of the surrounding air.

1148 - Feeding Experiments with Whole Milk and Skimmed Milk with Cream Substitutes (1). — WELLMANN. — Reprint from *Landwirtschaftlichen Jahrbücher*, pp. 499-626. Berlin, 1914.

The writer made comparative experiments on the utilization of whole milk and of skimmed milk with cream substitutes for feeding calves and young pigs.

The fresh whole milk of the day was pasteurized for a quarter of an hour, then cooled and kept in a cool place in well closed cans.

The additions to the skimmed milk consisted of meal and of flour starch saccharified by diafarine (a preparation of diastase); it was also homogenized with a preparation of tallow known in trade under the name of "Premier jus".

The skimmed milk with meal was prepared as follows: the daily fresh skimmed milk was passed through a sieve and pasteurized; while still warm it received the addition of 54 parts of wheat meal, 27 of rye meal and 1 of common salt per 1000 parts by weight of liquid. The mixture was passed a second time through a fine sieve and then kept in a well closed vessel.

The diafarine skimmed milk was prepared in the following manner: After being passed through a sieve and pasteurized it was cooled to 55-60° C. and mixed with 50 parts by weight of wheat meal, 25 parts of rye meal and 7.5 of diafarine per 1000 parts of liquid.

In another experiment skimmed and whole milk were mixed and to this mixture (containing 2.5 per cent of fat), 50 parts of wheat meal and 25 of rye meal per 1000 were added, together with 7.5 parts of diafarine with the object of saccharifying the meal starch. This preparation is called by the writer "Diafarin-Fettmilch".

The homogenized milk was prepared by mixing the tallow preparation intimately with skimmed milk.

Eleven pigs from two to four weeks old were experimented upon; two of these were slaughtered at the beginning of the experiment as controls, the others at the end. The milk was always given *ad lib*.

The experiment showed that from a dietetic point of view whole milk, diafarine milk, and skimmed milk with meal gave the best results; no intestinal troubles occurred with the use of these feeds. The animals seemed to relish most of all the diafarine milk. The homogenized milk was always willingly taken, but one animal fed on it had an attack of scour which was soon arrested by some citric acid.

The digestibility of the various milks was, on the whole, the same, even when that of the individual foods was different. The high digestibility of the fat in the homogenized milk was striking; although there was 6 per cent of fat it was utilized even better than in the whole milk. Protein proved more digestible in the milk with wider albuminoid ratio (homo-

(1) See also the original articles: 1) Prof. PAUL SCHUPPLI, Calf Rearing on the Emulsion System, *B.* Feb. 1913, pp. 167-173; and 2.) Prof. ANTONIO PIROCCHI, Utilization of Skimmed Milk as Food for Calves, *B. Aug.* 1913, pp. 1157-1164. (Ed.).

genized milk) than in that with a narrower ratio (whole milk, diafarine-skimmed milk). In most cases the young pigs utilized the milk better as they grew older.

The greatest assimilation of nutritive matter per 1000 of live-weight was observed with diafarine-skimmed milk (35.93), and "diafarin-fett milch" (38.5), and meal and skimmed milk (45.53). With whole milk the corresponding figure was only 30, and with homogenized milk 30.47. In the consumption of starch values the difference between the four kinds of milk was barely 15 or 20 per cent.

The daily increase per 100 lbs. of live-weight ranged from 2.2 to 3.5 lbs., and diminished with increasing age. It varied from 3.08 to 3.34 lbs. for whole and homogenized milk; it was 3.25 lbs. for diafarine-skimmed milk and 3.5 lbs. for "diafarin-fett milch". The pigs retained in their bodies from 36 to 74 per cent. of the digestible nitrogen supplied.

From an economical point of view, diafarine skimmed milk was the most satisfactory and "diafarin-fett milch" the least.

The cost of one pound of gain varied with the different feeds as follows :

	<i>d</i>
Whole milk	7.11
Diafarine-skimmed milk	3.10
Meal-skimmed milk	3.53
Diafarin-fett milch	7.80
Homogenized milk	4.65

Thus, feeding with diafarine-skimmed milk costs about one-half, and with homogenized milk about two-thirds of the expense of feeding whole milk.

In the pigs fed on diafarin the flesh was singularly light coloured.

The paper contains data on the weights of the different organs of the pigs and on the analysis of the flesh.

1149 - **The Breeds of Horses of the Sunda Archipelago.** -- VON BARNEKOW, HANS, in *Zeitschrift für Gestützkunde und Pferdezucht*, Year 9, Part 9, pp. 194-198. Hanover, September 1914.

This paper is a brief review of the most important breeds of horses of the Sunda Archipelago, namely : Sandalwood, Macassar, Sumbawa, Savonese, Timor, Batak, Boverlander, Java and Preanger.

The *Sandalwood* horse is a native of Soemba island and is considered on the whole as the best of the archipelago. For scores of years it has been exported in numbers to Java ; consequently the stock has diminished to such an extent that measures had to be taken for the preservation of the breed. Its body is compact and is supported by sound and strong feet, so that the horse is especially suited for the saddle. The strong strain of Arab blood with which it has been credited can no longer be recognized in it owing to long-continued inbreeding. The Sandalwood has a very regular pace and is an excellent trotter. It combines a lively fiery temperament with great good nature. Its coat varies, but jet black, dark brown and piebald are the commonest.

HORSES
ASSES
AND MULES

The *Macassar* breed found in Celebes is the one that approaches most the Sandalwood. It is smaller and not so handsome, but its frame is stronger, it is more resistant and thriftier and it is much appreciated as a cavalry horse. It is bred by the natives, who are distinguished above all the other Malays for their skill in breeding. Nevertheless this breed is threatened, more than any other breed, with extinction, as hitherto neither the Government nor the leading breeders have been able to control the destructive disease known locally as "Niewe Ziekte".

The third breed of the Sunda Archipelago is that of the *Sumbawa* horses, from the island of the same name. They are decidedly draught horses and possess powerful limbs with clean bones and sound hoofs. They are smaller than the preceding breeds and combine a good nature with extraordinary resistance, which renders them very suitable for artillery. At present Sumbawas are the most numerous breed in the islands. Their exportation ranges between 8000 and 10 000 head per annum. The dreaded Tambora disease, a consequence of shortage of forage and of drought, has never sensibly diminished the stock of Sumbawa horses.

The next breed allied to the Sumbawas is the *Bimanese*; it is a native of the same island and is chiefly used for the pack saddle.

A special breed is the *Savonese* from the island Savoe. The horses of this breed are not very numerous; they are the result of a cross with the Sandalwood and, like the allied Rottinese breed, are fast carriage horses; they are much esteemed and exported to Java and Celebes.

The *Timor* breed, from the island of Timor, is really a diminutive Sandalwood. It was once held in great repute, but continuous inbreeding has so deteriorated it that its exportation has greatly diminished. Endeavours are now being made to restore this excellent breed to its original high level.

A horse that outwardly much resembles the Sandalwood is the *Batak*, which for its usefulness is superior to all the other breeds. Its real home is the high plateau of Sumatra, and especially the shores of the great Toba lake. Its conformation is handsomer than that of any other breed and renders it as suitable for the saddle as for draught. Batak horses are in great demand on the tobacco plantations of British India, Singapore, Malacca and Penang.

The collective name of *Bovenland* horses is given to all the other breeds of the west coast of Sumatra. They differ a good deal in build and usefulness from each other; they are heavier than the preceding breed, and do not equal them in general utility. Many fine and strong stallions are to be found among them, but unfortunately they are not used for breeding purposes but as saddle horses.

The *Java* horse is an insignificant, weak animal, suitable only for light draught. It is bred chiefly in the mountains; the best animals, however, are found in the rich grazing districts of the south coast.

The last breed of the Sunda archipelago which deserves mention is the *Preanger*, which owes its origin to the crosses of Persian, Arabian, and east European stallions with Java mares. Later Australian, Cape

Sandalwood, and Macassar blood was introduced for its improvement. From this mixture of various bloods a breed has been formed which is equally suitable for riding and for driving. Unfortunately it is bred only in the island of Preanger, and thus it is mostly known to the white population only by name. Its exterior conformation is especially harmonious.

1150 - **Holstein Milk Yield.** — MARSHALL, F. R. (Bureau of Animal Industry, U. S. Department of Agriculture) in *The Journal of Heredity*, Vol. V, No. 10, pp. 436-439. Washington, D. C., October 1914.

CATTLE

The study reported in this paper relates to inheritance, through paternal and maternal lines, of factors controlling the production of butter-fat. It consists in the examination of records of cows as reported in the Blue Book compiled annually from the Advanced Register for the Holstein Breed. Here only selected material is dealt with, as only the good yields are registered. These were all seven-day records made at various ages and giving the pounds of milk yielded, pounds of fat and per cent of fat.

In Vol. 10 of the above Register, there were found 1317 cases of cows having official records and whose paternal grandams also had records. In addition, there were 678 cases in which a record-making individual had a maternal grandam with a record.

The difficulty of variation in age was overcome by arranging the "paternal grandam" and "maternal grandam" cards in two parallel sets. Having a much larger number in the paternal set it was possible to select therefrom, for each maternal card, one in which the age of the cow and of the grandam corresponded very closely. This arrangement left 665 cards in each group.

The coefficient of correlation for each group in respect to total milk, total fat and per cent of fat, is shown in the accompanying table (1).

Taking the opposing pairs of cards in order to see in which there was the greatest similarity between the records of grand-daughter and grandam the following results were obtained:

	Number of cases in which resemblance was closest	
	on maternal side	on paternal side
Pounds of milk	403	262
Pounds of butter-fat	407	258
Per cent. of butter-fat	345	320

(1) DAVENPORT'S statistical method is adopted.

M, represents the average of the readings.

Em, the probable mean error.

G, the standard deviation.

E G, the relative probable error.

r or \sqrt{r} , the correlation coefficient.

Er, the relative probable error.

(Ed.).

	M	Em	G	EG	r	Er
Pounds of milk.						
<i>Through Sires.</i>						
Grand-daughters	370.6	± 2.29	88.5	± 1.67	— 0.05	± 0.025
Grandams	475.3	± 2.56	98.7	± 1.95	— 0.05	± 0.025
<i>Through Dams.</i>						
Grand-daughters	393.4	± 2.63	99.5	± 1.95	— 0.012	± 0.02
Grandams	437.4	± 2.09	80.8	± 1.54	—	—
Pounds of butter-fat.						
<i>Through Sires.</i>						
Grand-daughters	12.68	± 0.089	3.41	± 0.062	— 0.04	± 0.025
Grandams	16.93	± 0.108	4.14	± 0.076	—	—
<i>Through Dams.</i>						
Grand-daughters	14.00	± 0.101	3.97	± 0.07	0.06	± 0.026
Grandams	15.83	± 0.087	3.31	± 0.06	—	—
Percentage of butter-fat.						
<i>Through Sires.</i>						
Grand-daughters	3.47	± 0.009	± 0.432	± 0.008	0.107	± 0.02
Grandams	3.57	± 0.011	± 0.448	± 0.008	—	—
<i>Through Dams.</i>						
Grand-daughters	3.55	± 0.011	± 0.445	± 0.008	0.213	± 0.02
Grandams	3.50	± 0.013	± 0.488	± 0.009	—	—

In the two sets of cases already discussed there was a smaller number of paternal than of maternal grandams, due to the fact that cows have many more grand-daughters through their sons than through their daughters. This objection and the further objection as to environmental influence upon total production is removed in a further study relating entirely to per cent. of butter fat.

In the second part of the study of this case there were taken 126 record cows having record grand-daughters through both sons and daughters. The number of grand-daughters is 340 through paternal descent and 340 through maternal descent from 126 common grandams. Each grandam was represented by not less than one nor more than six grand-daughters in either line. Here also the ages of granddaughters and grandams in one line correspond closely with those in the other line. The means, standards of deviation and coefficients of correlation in this case of common grandams were as follows :

	M % fat	E	G	E	
<i>Paternal Descent.</i>					
Grand-daughters	3.52	± 0.02	0.442	± 0.01	$\sqrt{\quad} = 0.157$
Grandams	3.51	± 0.02	0.406	± 0.01	E ± 0.028
<i>Maternal Descent.</i>					
Grand-daughters	3.60	± 0.02	0.489	± 0.01	$\sqrt{\quad} = 0.155$
Grandams	3.51	± 0.02	0.406	± 0.01	E ± 0.028

The difference between 0.155 and 0.157 does not indicate any difference between transmission of the character of percentage of butter-fat in milk through males and females. The impression to the contrary held by some cattle breeders is not borne out by this investigation.

1151 — **Economical Cattle Feeding in the Corn Belt.** — CORRON, J. S. (Agriculturist, Bureau of Plant Industry) and WARD, W. F. (Senior Animal Husbandman in Beef Cattle Investigations, Bureau of Animal Industry) in *U. S. Department of Agriculture, Farmer's Bulletin*, No. 588, 19 pp. + 6 figs. Washington, 1914.

The cattle-feeding business in the corn belt of the United States has changed greatly during recent years. Formerly steers from 4 to 6 years were fed in large numbers upon commercial foods at yards near granaries or mills, or on large farms where only the roughage was grown and the cattle were kept on full feed for six months or longer. This method, however, became too expensive, so the cattle are now usually fed in small herds up to the age of 18 to 36 months, utilizing the products of the farms.

The cattle were either grown in the corn belt itself or came from the western ranges. The native cattle were usually grown on the rougher farms or on small farms where dual purpose cows were kept. They were usually sold to local feeders as yearlings or two-year-olds. Some feeders desiring animals of extra good quality raised their own feeders. The rapid advance in the prices of land and farm products made it unprofitable to compete with the western ranges in the production of stocker and feeder cattle. Therefore the breeding herds were greatly reduced or were changed to dairy cows.

On the other hand, the spread of dry farming has resulted in the best lands of the open range being taken up for grain-growing purposes, and the excessive liquidation of cattle has resulted in a shortage of feeder cattle and raised their price, so that securing feeders is a serious problem which must be solved by many farmers raising their own cattle. On the high-priced lands capable of intensive cultivation it is questionable if this can be done economically, but there are numerous farms within this region where a considerable proportion of the land is too rough for economical tillage and on which, with prevailing prices, stock cattle can be raised advantageously.

Cost of producing cattle. — The cost of raising a calf six months old weighing 450 pounds varies from \$17 to \$23 in the West and from \$20 to \$28 in the East. In a ranch in Kansas, where land is worth \$50 an acre, the cows being valued \$70 each and assuming that 85 per cent of them drop a calf every year, the cost of a calf is \$22.93 and at the age of 2½ years about \$55. This figure is about the maximum cost of such a steer in the maize belt, and many of the western ranches raise similar steers for less money. It has been observed that the cost of the calf will be a little less if it is weaned and the milk sold, than if it is allowed to run with its mother.

While in 1899, 883 857 calves, having an average value of \$8.20, were slaughtered in the wholesale slaughtering houses, in 1909, 2 504 728 calves with an average value of \$10 were slaughtered, an increase of 183 per cent. in 10 years, whereas the corresponding increase in cattle for the same period was but 47 per cent. This growing demand for veal has raised its price, until a calf will sell from \$8 to \$12 when only 2 or 3 months old, so that it is usually more profitable to sell them to the butcher than to raise them.

In order to determine as accurately as possible the cost of feeding, cost-accounting records were kept for two years on 24 Iowa farms. During the year beginning with the autumn of 1909 the average profit on 961 cattle fed in 22 bunches was \$2.05 per head in addition to the profits on the 1504 hogs following these steers, and which received extra grain besides. Market prices in the spring of 1910 were such that a profit of \$6.67 per hog was secured. The following year 1910-11 proved unsatisfactory, due to prices which caused a loss of 78 cents per head on 1138 cattle that were fed on 28 farms. The 1646 hogs following these steers returned an average profit of \$3.33.

The following table shows the proportionate cost of different items based on the cost-accounting records of the 24 Iowa farms.

Percentage of the various expenses incurred in cattle feeding.

Year	Purchase price	Feed	Interest at 6 per cent	Labour	Shipping and selling	Total
1909-10 .	55.8	36.9	1.3	1.6	4.4	100
1910-11 .	59.9	31.8	1.8	1.8	4.7	100

In this table no account is kept of interest, taxes, and depreciation charges on the feeding plant, as these and other incidental charges are about offset by the value of the manure.

According to experiments made at the Missouri Experiment Station, it appears that a bushel of maize will produce 6.9 pounds of gain when the cattle are fed on pasture in summer, as against 5.6 pounds in winter feeding. Therefore in general summer feeding is considered more profitable. On

the other hand winter feeding allows of the better use of the by-products and of the better distribution of labour.

Formerly 6 to 8 months were required for making prime beef. Now cattle are rarely kept on full feed for more than five months.

The construction of a silo (over ground, on a circular base) is not economical unless at least 100 tons of silage are consumed. Besides, in years of cheap alfalfa or clover, when hay is worth less than \$8 per ton, it is doubtful if silage costing \$3 a ton will prove economical. However, when hay is dearer silage will be profitable.

Considering the limited margin of profit on breeding beef it is prudent to combine it with hogs following the fattening cattle, for the former utilize a greater quantity of the by-products. The best type of hog to run behind cattle is a shoat weighing about 100 pounds; heavy nearly finished hogs are not profitable behind steers and should be placed by themselves.

It is usually best to allow one shoat per steer when shelled maize is fed and two when ear corn is used. When the maize is ground or soaked, or silage is used, the number of hogs would be less. The aim should be to run enough hogs to clean up all the waste maize.

The daily gain of the hogs varies with the conditions of the feed yard and the quantity and form of the grain given. In general one may reckon on three-fourths of a pound of pork per third of a bushel of shelled maize fed per steer. When ear maize is fed the gains will be greater and when maize, or maize and cob meal is fed, less.

The gain will be greater if the steers are fed some leguminous hay or some concentrate high in protein, such as oil cake.

Nearly all farmers give the hogs some extra maize, which is fed away from the steers.

The shrinkage in weight in shipping cattle from Iowa to Chicago or from points in Kansas to Kansas City would be from $3\frac{1}{2}$ to 5 per cent of their live-weight, with an average of 4 per cent.

1152 - **Origin of Karakul Sheep** (1). — YOUNG, C. C., in *The Journal of Heredity*, Vol. V, No. 10, pp. 445-447. Washington, October 1914.

SHEEP

Some 26 years ago Dr. Sinitzin described the various breeds of sheep in Bokhara that produce valuable lamb skins. He distinguished; 1) the small Arabi, 2) the large Arabi, 3) the Duzbai, 4) the Shiraz, and 5) the Zigai breeds. He considers the small Arabi as the origin of all the fur-bearing sheep of Central Asia, including the Malitch of Crimea, the Tshushka of Bessarabia and the Reshetilev and Sokoliev of Poltova province.

According to this theory the small Arabi is descended from the Mamai, the oldest breed of domesticated sheep. But as the Mamai is a fat-rumped sheep (*Ovis steatopyga*) while all the Karakul breeds are broad-tails (*Ovis platyura*), the author does not endorse Dr. Sinitzin's classification; his own experience has shown him that when a long-tail sheep is crossed with a fat-rump the result is a broad-tail, and while the first cross looks more like a typical Russian fat-tail (Jirnochvostaja), the second and third crosses

cannot be classified otherwise than as broad-tails. He therefore concludes that the Karakul breeds resulted from crosses of long-tail sheep on fat-rumps.

In all the cases observed by the writer the black pigment in the wool of the mature sheep did not oxidize into gray as is the case with the Arabi and also with the Duzbai, for which reason he concludes that the small Arabi was a hybrid and a not very well fixed one, and that some black long-tail sheep together with a fat-rump entered into the formation of the breed.

The presence of fat-rump blood is easily traceable in the Duzbai, which has the long drooping ears that characterize *Ovis steatopyga*, the Roman nose, large head, very thick feet, enormous weight and a tail with fat accumulation; besides, the Duzbai lambs frequently come fawn, which is the natural colour of the fat-rump.

According to information collected by the writer at New Bokhara, 60 years ago there were neither Arabi nor Duzbai sheep in Bokhara; the only fur-bearing breed which produced beautiful fur was the black long-tail Danadar. In the spring of this year 1914 the writer was able to see the only flock of gray Danadar sheep which still exists in the Khanate of Bokhara, at about 100 miles from Old Bokhara, the capital of the Khanate. The owner of the flock said that after the conquest of Bokhara by Russia in 1865 the demand for Danadar lambskins increased and the natives began to cross their black sheep with white fine-wool Afghans. This in time produced the gray Danadar breed, the lambs of which produce skins with small curls rather open and lustreless. This introduction of white blood contaminated with fat-rump blood in time changed the black Danadar into the small Arabi. The cross of the black Danadar on the fat-rumps produced the Duzbai. The gray Shiraz evolved from the gray Danadar with a fat-rump admixture. The Zigai is a typical Russian breed that never existed in Central Asia, and if there are any they must have been taken there by Russian Tartars who settled in Turkestan. Sinitzin's large Arabi is the same animal as the Duzbai.

There can be no doubt that the Tshushka and Sokoliev — both long-tails — are also descended from the black Danadars. The Luk-Nakbo of Tibet and the black Gadik of Afghanistan, some few of which are still found between Mazar-i-Sherif and Cabul, are closely related to the black Danadar.

The writer has started an experimental farm in Bessarabia for the breeding of Karakul sheep; hitherto he has succeeded in securing Karakul sheep from the districts of Karshi, Kerki, Gissar, Tjarjui, Burdalik and Karakul. In Bokhara the Karakul breeds are hastening towards extinction, owing to the killing of all the good lambs and to the continuous infusion of fine-wool Afghan blood.

Hog pastures in the Pacific Northwest of the United States are generally managed in one of the three following ways: 1. — Continuous close

grazing. 2. — Alternate pasturing of equal areas. 3. — Pasturing the meadow on which hay is made also.

With the first method all the hogs the pasture will support are turned on it and left there during the entire season.

The second method consists in dividing the pasture into two or more fields of equal area, which are used alternately every week or ten days. In the case of clover and alfalfa the growth is allowed to become 3 to 4 inches high before the hogs are turned in. When the pasture consists of rape, kale, and vetch, the growth is permitted to reach a height of 8 or 10 inches before the hogs are turned in. A pasture thus subdivided is capable of carrying a much larger number of hogs per acre. Immediately the hogs are removed the pasture is clipped with a mower and sometimes irrigated. The third method consists in using clover and alfalfa for both pasture and ley at the same time. The number of hogs turned to graze is so limited that the usual crops of hay are made. When the forage becomes too large to furnish desirable feed a sufficient area near the watering place is clipped with a mower.

In a few days the clipped area produces a vigorous growth of new shoots upon which the hogs feed without disturbing the rest of the meadow. If necessary more of the meadow is clipped as required. Different portions of the meadow are used in this way from year to year.

Mature breeding stock that is not expected to make any gain in weight requires but little if any additional feed when on good pasture. But hogs which are to be marketed for pork must be fed some concentrated food.

If they are to be sold when 7 to 9 months old, in order to make them reach the weight demanded by the market (170 to 225 lb.) it is necessary to feed them all the grain they will consume. Hogs that are marketed when 10 to 12 months old get a much lighter feed of grain (from 1 to 3 per cent of the live-weight of the hog) or none at all during the grazing season.

Sometimes, instead of feeding the grain, the hogs are turned into a standing field of wheat, barley, peas or corn and allowed to feed at will until the crop is consumed. If they are provided with water, shade and salt, they require very little other attention, which saving of labour is very desirable during the busiest season of the year. This method is especially useful on the poorer soils, where the cost of harvesting is relatively high in comparison to the value of the crop and where the addition of more organic matter is very beneficial. The straw, pea-vines or corn stalks are cut in the autumn by a sharp disk harrow and ploughed in.

Wheat is generally hogged off for four to six weeks from about the stiff-dough stage. A soft variety of wheat with a smooth club type of head is the best for this purpose. The writer mentions two cases in which hogs pastured on wheat made an average gain in weight of 160 lb. and 212 lb. per acre, valued respectively \$14.40 and \$15.73 per acre, while the wheat alongside yielded 15 and 19 $\frac{3}{4}$ bushels per acre, the latter giving a net value of only \$8.04 per acre.

Field peas are one of the most satisfactory crops to harvest with hogs, which utilize them with very little waste. They may be used from the time

TABLE I. — *Crops for Western Oregon and Western Washington.*

Crops	When planted	Approximate date when used	Number of hogs an acre will pasture
<i>Pasture crops.</i>			
Clover	A previous year	April 1 to November 1	8 to 16
Alfalfa	do.	do.	8 to 16
Rape in rows.	April 1, 15 and 30	June 1 to November 1	8 to 14
Rape and oats.. . . .	April 25 to May 15	June 25 to November 1	6 to 15
Rape and clover	May 15 to June 1	July 1 to November 1	6 to 15
Rape	July (in corn at last cultivation)	October 1 to April 1	5 to 8
Vetch and wheat, vetch and oats, or vetch alone	do.	do.	5 to 8
Vetch and wheat or vetch and oats	September (on spring stubble)	November 1 to April 1	5 to 8
English rye-grass	Early spring or early fall	November 1 to July 1	5 to 14
Winter wheat	September 1 to October 15	February, March and April	6 to 12
Vetch	September.	March to July 1	8 to 16
<i>Grain crops.</i>			
Beardless barley	Early spring	July 1 to July 20	—
Winter wheat.	September and October.	July 10 to August 10	—
Field peas	Early spring	July 25 to October 1	—
Maize	April 20 to May 10	September 15 to November 15	—
<i>Succulent winter feeds.</i>			
Kale	Sown in March or April; transplanted in June.	October 1 to April 1	—
Squash	May 25	November 1 to January 15	—
Roots	April 1 to May 15	November 1 to April 1	—
Artichokes	Early spring	do.	—

TABLE II. — *Crops for the subhumid districts.*

Crops	When planted	Approximate date when used	Number of hogs an acre will pasture
<i>Pasture crops.</i>			
Winter wheat	Early in September	October 15 to November 15, March 15 to June 1.	5 to 8
Clover	April, previous year	April 10 to December 1	8 to 15
Alfalfa	A previous year	April 15 to November 15	8 to 15
Kale or rape	April and May.	June 15 to December 1	8 to 15
Rape and clover	May 1	June 10 to November 15	6 to 14
Winter wheat	Early in May	June 1 to November 15	6 to 15
Wheat in maize.	July 15 to 20 (at last cultivation of corn)	September 15 to November 15	6 to 12
Stubble field		August 25 to April 1	—
<i>Grain crops.</i>			
Beardless barley	Early spring	July 5 to August 1	—
Winter wheat	September and October	July 20 to August 20	—
Field peas	Early spring	July 10 to November 1	—
Spring wheat	do.	August 1 to September 1	—
Maize	May 1 to 20	September 1 to November 15	—
Blue barley or common beardless barley	Early spring	From beginning of autumn rains to midwinter	—
<i>Winter feeds.</i>			
Alfalfa hay	A previous year	November 1 to April 15	—
Sugar beets, mangolds, carrots, rutabagas	April and May	do.	—
Artichokes	April	October 15 to May 1	—
Unthreshed or bundle wheat	Autumn or spring	Late autumn, and early spring	—
Field peas (unthreshed)	Early spring	do.	—
Unthreshed or bundle barley	Autumn or early spring	do.	—

TABLE III. — *Crops for the arid and semi-arid districts.*

Crops	When planted	Approximate date when used	Number of hogs an acre will pasture
<i>Pasture crops.</i>			
Winter wheat	October	April 1 to May 15	6 to 10
Beardless barley	February or March	May 1 to June 15	5 to 10
Spring wheat	March	May 1 to July 1	5 to 10
Winter wheat or beardless barley	May	June 15 to August 1-25	5 to 6
Field maize and Early Amber sorghum	April 10 to May 10	July until autumn frosts	4 to 7
Stubble field		August 25 to April 15	—
<i>Grain crops.</i>			
Beardless barley	Early spring	June 20 until autumn rains begin	—
Winter wheat	October	July 1 " " "	—
Spring wheat	Early spring	July 15 " " "	—
Field peas	February and March	July 20 " " "	—
Blue barley or the common beardless barley	do.	October 15 to February 10	—
<i>Pasture crops.</i>			
Red clover	Previous year	March 25 to November 10	10 to 20
do. with wheat, oats or barley	Early spring	After grain is harvested to Nov. 10	10 to 20
Alfalfa	Previous year	April 1 to November 1	10 to 20
<i>Grain crops.</i>			
Beardless barley	Early spring, April	August 1 to November 15	—
Club wheat	September or October	August 5 to September 15	—
Field peas	Early spring, April	August 20 to November 15	—
Club wheat	do.	August 20 to October 1	—

TABLE IV. — *Crops for the irrigated valleys.*

the last peas are nearly mature until about October or until the beginning of the autumn rains.

Carefully conducted tests at the Minnesota Experiment Station show that hogs waste no more corn in the field than when fed in lots, and that they gather it as clean as most men do in husking. Farm experience bears out this conclusion, especially if a movable fence is used and the hogs are not turned into more corn than they can consume in 15 or 20 days.

For summer and early autumn hogging-off, common early-sown beardless barley is used. For late autumn and winter use the more productive bearded varieties are preferred, after the autumn rains have softened the beards and kernels.

The tables (pp. 1642-1644) give some data on the pasture crops used in Western Oregon and Western Washington.

1154—**Pig Feeding Experiments in Germany.** — KLEIN, in *Milchwirtschaftlicher Zentralblatt*, Year 43, Part. 47, pp. 452-458. Hanover, September 1, 1914.

Experiments were made with the object of ascertaining whether fish meal freed from fat and dried yeast can take the place of skimmed milk in the fattening of pigs.

In an eight-weeks preliminary experiment, three young pigs were given only skimmed milk besides a basal ration of potato flakes and barley; ten other young pigs divided into two equal groups were given the same ration as the preceding three, with the difference that a part of the milk was replaced in one lot by fish meal and in the other by yeast. One gallon of skimmed milk was always replaced by $\frac{1}{2}$ lb. of fish meal + $\frac{1}{2}$ lb. of potato flakes, or by 1 lb. of yeast. The course of the experiment was normal. The increase of live-weight per day and per head was as follows:

	lbs.
Lot I	1.24
» II	1.10
» III	1.13

The lower result yielded by the group fattened with fish meal is perhaps due to the lower amount of protein in the ration.

In a following experiment lasting 12 weeks the same pigs (minus one, which was eliminated) were divided into three equal lots. The rations were the same as in the preparatory period, with the difference that lot II had all the skimmed milk replaced by fish meal and that an extra quantity of fish meal + potato flakes was given to replace the skimmed milk. Further the yeast was steeped in warm water. The animals fattened with skimmed milk showed in general the greatest appetite, those fed with yeast the smallest. With this exception the course of the experiment was normal. The following is the increase of live-weight per day and per head.

	lbs.
Lot I	1.44
» II	1.42
» III	1.39

The small difference in the three lots leads to the conclusion that the fish meal and yeast produced almost, if not exactly, the same effect as skim milk. Yeast and fish meal, but especially the former, gave a better result with the older pigs than with the younger ones. As regards fish meal, this is probably due to the fact that the older animals gain chiefly in fat and are satisfied with less protein than the younger ones, which have to form flesh also.

From the economical point of view the principal experiment yielded the following results. If for the skim milk the values of 1.07 *d* or 1.6 *d* per gallon be assumed, and for the other feeds the prices actually paid on the market (fish meal 10s 6*d*, yeast 11s 6*d*, potato flakes 8s, and barley 7s 6*d* per cwt.), the cost of 1 lb. of gain in live-weight will be as follows:

Cost of skim milk per gal.	Lot I <i>d</i>	Lot II <i>d</i>	Lot III <i>d</i>
1.07 <i>d</i>	3.53	3.69	3.69
1.60 <i>d</i>	3.85	3.69	3.90

In general these results are in favour of fattening with skim milk if this is valued at the low price of 1.07 *d* per gal. If the skim milk be valued at 1.6 *d* per gal., the best results are obtained with fish meal and the less favourable ones with yeast. But if the greater dietetic value of skim milk be compared with this result, the conclusion may be drawn that skim milk valued at 1.6 *d* per gal. is at least as advantageous for young pigs as for the older ones. Whenever skim milk may be purchased at a price below 1.6 *d* per gal. its substitution by fish meal or yeast does not offer any advantage.

The carcase weight and the quality of the flesh were the same in the three lots.

BEES

1155 - **Apiculture in Uganda.** - *Communicated by the Acting Director of Agriculture, Uganda.*

In 1907, Sir H. Hesketh Bell, K. C. M. G., Governor of Uganda, being impressed by the value of the exports of beeswax from German East Africa, decided to introduce the industry into the Uganda Protectorate.

In August 1908 two natives of Uganda were sent to German East Africa to study the methods of preparation of beeswax followed in that territory. These men spent two months in German territory. On their return to Uganda they were sent out to instruct the peasantry in the preparation of wax.

The introduction of the beeswax industry was taken up in every district of the Protectorate. The idea was to put up log hives and encourage wild bees to take up their quarters in them. Tens of thousands of these hives were put up all over the Protectorate. Pamphlets were published in several native languages, and beeswax instructors were appointed to all the districts. The following statement shows the exports of beeswax from the Protectorate for the last five years:

Year	Lbs.	Value
1909-10	4 043	£ 154
1910-11	3 950	£ 162
1911-12	3 539	£ 162
1912-13	2 352	£ 117
1913-14	882	£ 42

There are several reasons for this failure of the effort to introduce a new industry. The quantity of wax obtainable from a hive of wild bees in Uganda is very small, several hives have to be taken to produce a small cake of wax. The natives found the taking of the hives unpleasant and the preparation of the wax laborious; and since, when the process was complete, they got a smaller return than from any other method of earning money, the extraction of beeswax never became a popular industry. In fact, nearly all the wax which was produced was prepared by the beeswax instructors who were paid by Government to teach the peasants.

The following is a brief account of the methods employed: "Log hives were put up in the branches of trees and a few of these were tenanted by bees. When the hives were nearly full, the bees were smoked out and the comb was taken. The brood comb and a small amount of honey comb were left in the hive. The honey was then squeezed out of the comb, and the comb was boiled. The floating wax was drawn off and strained. The wax was subsequently broken up and clarified by melting and straining".

1156 - The Silk Weaving Industry of Amarapura, Burma. — SHROFF, K. D., in *The Agricultural Journal of India*, Vol. IX, Part III, pp. 254-287 + 6 plates. Calcutta, July 1914.

SILKWORMS

Sericulture in Burma has been almost exclusively in the hands of a curious race of people, the Yabeins, who numbered about 2 197 in Lower Burma in 1891.

It also exists to a small extent in Upper Burma and the Shan States. The rapid decline of the industry is shown by the decrease in the number of silkworm breeders from 3102 in 1891 to 211 in 1911.

This decline is attributed to the following causes:

- 1). The crude and careless system of rearing and inter-breeding and consequent degeneracy of the breed.
- 2). The ravages of diseases.
- 3). The imperfect knowledge of the reeling of the silk and the consequent production of coarse, uneven thread unsuitable for local consumption or export.
- 4). The abundance, the cheapness and the superiority of the imported raw silk.

Raw silk is imported from the Straits Settlements, Siam, Indo-China, China and Japan. The value of the silks imported decreased from 29 15 805 Rupees (£195 000) in 1898 to 14 18 306 Rupees in 1910, but since then it has increased to 31 44 189 Rupees (£209 000) in 1913.

The imports from China appear to be supplanting those from the Straits and elsewhere.

These figures do not support the opinions that the weaving industry of Burma is in a decadent condition owing to the competition of finished machine-made products. In 1911 there were no less than 18 621 people engaged in silk spinning and weaving.

The writer gives an account of the types of silk and handlooms used by the Burmese, and descriptions of their designs. A cooperative credit society has been established, and improved methods of manipulation and handlooms are being introduced.

1157 - **Researches in Sericulture in Cambodia.** — DE FLACOURT, MARTIN (Chef des Services Agricoles et Commerciaux du Combodge), in *Gouvernement Général de l'Indochine, Bulletin économique de l'Indochine*, Year 17, No. 108, pp. 388-389. Hanoi-Haiphong, May-June 1914.

Since April 1913, the Agricultural Service of Cambodia has undertaken the work of improvement by systematic selection of the pure native breeds of silkworms. It was therefore decided that the Service would not purchase any more foreign cocoons for the production of eggs, but produce them all in its own farms. With this object in view the Silkworm Breeding Station at Petit-Takéo conducted the breeding work in three lines: 1) pedigree or line breeding; 2) reproduction from eggs selected from the best cocoons of the pure lines; 3) the breeding of the best cocoons for industrial purposes.

The results obtained from one year's work give every confidence for the ultimate success of this method. Two local breeds (one a white worm with yellow cocoon known as Tân Châu, and the other a greenish yellow worm with golden yellow cocoon known as Tãm-sé) were brought to a state of absolute purity and improved with respect to increase of specific gravity of the cocoons and increased fecundity of the females. Thus, whereas it formerly required 1635 cocoons of Tân Châu or 1870 cocoons of Tãm-Sé to weigh one kilo (three days after the worms begin to spin), at the end of the breeding experiments in February and March 1914 it required only 970 and 1355 cocoons respectively. During the same period the egg-laying capacity of the females was increased from 275-350 per day to 400-475, with a maximum of 500-550, that is to say, that, according to local methods of calculation, the weight of cocoons from the eggs of 100 females would weigh from 55-66 lb. to 75-105 lb. The average price of 100 batches of eggs decreased from about 1s 3d to 6d and the demand for supplies from the natives increased enormously.

These experiments at Petit-Takéo lead to the belief that pébrine has a marked tendency to diminish and disappear in Cambodia, because the local conditions are undoubtedly unfavourable to the completion of the life-cycle of the disease, owing to the rapid evolution of the silkworms (40 days being sufficient for the complete development of the two local breeds). Very badly diseased eggs (showing 200 corpuscles of pébrine in the field of the microscope) have been bred and reared with healthy eggs of the same breed. Only the new generations showing the most disease were reserved. It was found that not only the number of corpuscles gradually diminished, but cocoons have been obtained from the diseased eggs almost

equal to those from the healthy control lots and after 6 successive generations only $1\frac{1}{2}$ per cent of the individuals were diseased, showing only 6 to 8 corpuscles in the field of the microscope.

FARM ENGINEERING.

1158 — **Motor Tillage Machine with Oscillating Spades turning Sideways.** — *Kaiserliches Patentamt, Patentschrift No. 273 777. Berlin, May 7, 1914.*

AGRICULTURAL
MACHINERY
AND
IMPLEMENTS

Several digging machines with movable spades have been constructed. In some the spades are attached to revolving drums and are driven into the

Fig. 1.

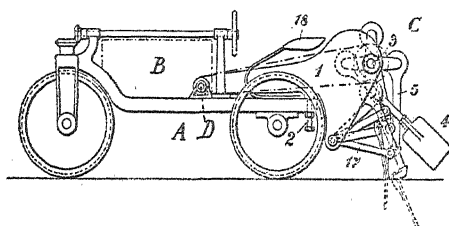


Fig. 2.

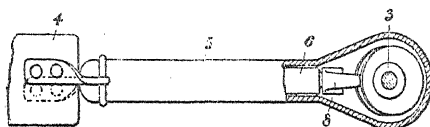


Fig. 3.

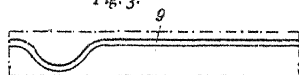
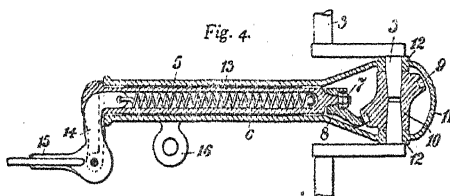


Fig. 4.



Motor Digger.

soil by the weight of the machine. In others they are independent of each other and move up and down by an excentric. In both types the spades have also a lateral movement calculated to turn over the earth as it is spaded.

In this machine patented by H. Kleinert in Germany under No. 273 777 the spades oscillate on a crank shaft and turn sideways to discharge and turn over the earth. Fig. 1 shows a side view of the machine and figs. 2, 3 and 4 some of its details. B is the motor, mounted on the truck frame A, which propels the machine and drives the spading appliance C, which is borne by two side plates (1), the front end of which is fixed to the frame in D by pivots; the other extremity can be raised or lowered by the screw (2).

The plates (1) carry the bearings of the crank shaft (3), each crank of which bears a spade holder (5). The cylindrical part of these holders contains the handle (6) of a spade (4), which is fastened to a knee piece working on a bolt situated on a lateral extension of the handle, the other end of the knee piece being attached to a spring (13) inside the handle (6). The upper end of this bears a head piece (8) carrying a roller that runs in a groove (9) in the head (10), which is fixed to the crank of the shaft (3) and which joins the two portions of the same crank (3). Each of these heads is enclosed in a case (11) fitted with two bearings (12). The case, which efficiently protects the mechanism against dust, earth, etc., is provided with means of lubricating the working parts to ensure smooth running.

On the outside of the holders an eye (16) is fixed for the reception of one end of the lever (17) (fig. 1), the other end working on a shaft, common to all the levers, fixed in the side plates.

When at work these spades are situated with their face to the direction in which the machine travels; as soon as they are raised they begin to turn sideways and thus discharge and turn the earth over. This turning motion is effected by the roller in the groove (9) of the head (10); the development of the groove is shown in fig. 3.

The spring (13) allows of stones and similar obstacles being encountered in the soil without causing injury to the machine.

1159 — The Rapid Drying and Preservation of Wood by Nodon's Electrical Process. — DANTIN, CH., in *Le Génie Civil*, Vol. LXV, No. 5, pp. 98-101. Paris, May 30, 1914.

M. Albert Nodon, the electrician, has been studying since 1896 the subject of the rapid drying and preservation of wood, and has now perfected his system and rendered its application practical. He had discovered that a current of electricity sent through wood set up chemical, physical and aseptic actions which led to its preservation; the first of these consists chiefly in a complete and rapid oxidation of the resinifiable substances contained in the sap. The physical action caused a molecular transformation in the cellulose and its numerous derivatives, modifying their mechanical and putrescible properties and rendering them resistant to destructive germs coming from without. Lastly, the aseptic action consists in the complete destruction of all the germs of corruption, such as ferments, bacteria, fungi, etc., contained in the wood. Besides the above effects it has been found that "nodonized" wood withstands the attacks of injurious insects, such as termites, which no longer find in it their usual food.

One of the most important desiderata in the timber trade is the rapidity of seasoning timber, for any long stay in the timber-yard means an immobilization of considerable capital. Consequently the use of heated and

ventilated esiccators is often resorted to, but such esiccation is mostly only superficial and on exposure to the air moisture is again absorbed. As the presence of sap hinders esiccation, steam at high temperatures and under pressure is often used to remove it, but this process is injurious to the resistance, tenacity and preservation of the wood and renders it inferior to air-dried wood. Besides, these processes of esiccation are expensive, as they entail costly plant, and much fuel and labour.

M. Nodon's process, or "nodonization", on the contrary, causes in a few hours the complete oxidation of the sap, which in air-drying requires

Fig. 1.

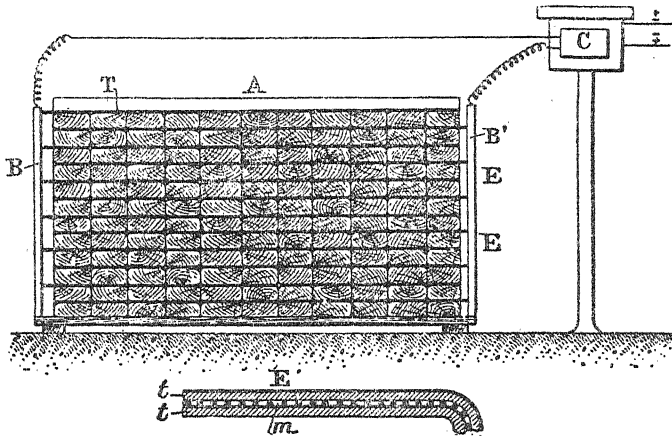


Fig. 2.

Fig. 1. — Section of a stack of railway sleepers under treatment.

Fig. 2. — Section of electrode mat.

B B'. Conductors to the mats.

C. Current distributor.

E. Electrode mats.

T. Sleepers.

m. Wire net.

t. Jute cloths.

such a long time; the substances other than cellulose, even in the innermost portions of the wood, are transformed into resins and completely deprived of their hygroscopicity; thus nodonized green wood loses its moisture rapidly on exposure to the air, while untreated wood dries only on the surface during the same time.

This process can also be applied to unbarked timber even 5 or 6 months after felling, as it still contains enough sap and moisture to conduct electricity.

The green timber to be treated, if in planks, railway sleepers, etc., is stacked to a height of three to five feet in layers separated from each other

by electrode mats in which the current passes (fig. 1). The mat (fig. 2), which can be rolled up for transport, consists of a pliable galvanised iron wire netting placed between two strong jute cloths. These mats are stretched between the tiers of timber and saturated with water to render them good conductors; the wirenets are connected with electric conductors, the poles of the mats being alternated so that the current may pass through the thickness of each layer.

The conductivity of wood varies considerably with its kind, thickness, degree of moisture, etc. Its resistance varies from 6 to 20 Ohms per cubic meter (35 cub. ft.), but it remains fairly constant throughout the duration of the treatment. Continuous currents may be used, but alternating currents are preferred. Treatment in the forest where the timber is cut is very advantageous when the wood is in full sap and in summer. The trees are cut up by electric saws driven by a dynamo and a portable engine stoked economically with the waste wood; after being nodonized, the timber is stacked in a place exposed to the wind where it dries completely in a few weeks.

The duration of the treatment varies between one and two full days according to the kind of wood and the use to which it is to be put. When treated too rapidly the wood is liable to split, though its keeping qualities are the same as if it had been treated slowly.

The total quantity of current that 1 cub. metre (35 cub. ft) of wood must have for its complete treatment is 150 Ampère-hours. Wood in full sap does not require above 40 volts electro-motive power, while for unbarked wood that has been kept some time 80 to 100 are necessary.

Nodonized wood is freed from starch and contains resinified substances throughout its whole mass, and its cells present a characteristic regularity. These changes allow nodonized timber to be easily distinguished from that which has not been treated.

The cost of the plant consists in the source of the alternating current and in the electrode mats; the latter cost about 4*d* per square foot, and they last about a year. As 3 sq. feet are required for the daily treatment of 1 cub. foot of wood, the cost of the mats is about 0.03 *d* per day per cubic foot.

The cost of nodonizing wood is about $\frac{3}{4}$ *d* per cubic foot, when the work is done in the forest, fuel, carriage and general expenses being cheaper than in factories, where the cost amounts to a trifle over 1*d* per cubic foot.

The process is useful wherever wood is used: in ship building, railway construction, carpentry, etc. The Municipality of Bordeaux has officially recognised that nodonized wood used for road paving lasts longer and wears better than untreated wood.

1160 - **A Latex Hydrometer.** — EATON, B. J., in *The Agricultural Bulletin of the Federated Malay States*, Vol. II, Nos. 9 and 12, pp. 224-226 and 314-322. Singapore, April and July 1914.

Messrs J. J. Griffin and Sons, scientific apparatus makers, Kemble Street, Kingsway, London, have constructed from detailed instructions

given by the writer, a delicate glass hydrometer graduated at 84° F. An average pure latex containing about 30 per cent of rubber has a density of about 0.98. A latex containing about 35 per cent of rubber is so viscous as to render it impossible to test its density directly. It is therefore recommended in such cases to dilute with an equal volume of water. The rubber content will then be double that corresponding to the density of the diluted latex.

Among the various services that this instrument can render is that of allowing the latex to be diluted with water to such an extent that its density will be constant. In this way very uniform results can be obtained in the preparation of smoked sheet. A satisfactory density figure at which to work is 0.9898, indicating a latex containing 15 per cent of rubber.

1161 — **New Water-Raising Device.** — *Les Inventions Illustrées*, Year 17, No. 11, p. 3. Paris, April 30, 1914. — *Engineering*, Vol. XCVIII, No. 25232, p. 10. London, July 10, 1914.

Among the smaller machines exhibited at the Royal Agricultural Society's show held at Shrewsbury this year, a very interesting water-

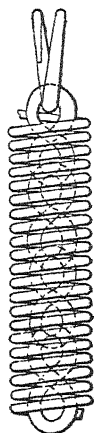


Fig. 1

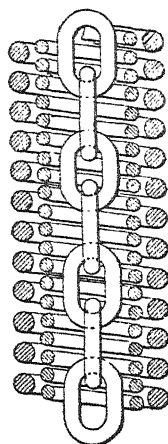


Fig. 2

New Water-raising Device.

raising device was exhibited. This appliance is virtually a chain pump, with nothing but the loop of an endless chain depending into the well. To keep the chain in place a deep rimmed pulley is slung in the lower loop of the chain. At the top end the chain is run over a pulley wheel worked by gearing. This pulley is enclosed in a casing with a delivery pipe leading away from the lower portion. The chain consists of a link chain surrounded by a spiral, fig. 1, and for larger capacities by a multiple spiral, fig. 2. The lower part dipping into the well catches up the water while the spiral is opened by the curvature of the pulley, and retains the bulk of it till the highest part is reached, when the centrifugal force, while the spiral is

bent open at the top pulley, throws the water out into the casing, whence it flows away. The capacity of this simple appliance is surprising, and it will handle water from considerable depths. The apparatus requires no permanent fixtures in the well at all, no buckets, guides, etc.

A double spiral 1. 7 inches in diameter with a 5 HP motor is said to draw up from a depth of 196 feet 2090 gallons per hour.

At a depth of 33 feet a triple chain 2.48 in. in diameter can deliver 5060 gals. per hour with 2.4 HP. For wells in which the level of the water varies, the chain is made up in lengths which can be readily joined together by special hooks, so that about 2 feet of the chain should always dip into the water, with which immersion it has been found to give the best yield.

On account of its simplicity this pump is not expensive; it is easy to transport and to set up without skilled artisans.

1162 - Review of Patents.

Tillage Machines and Implements.

- | | |
|-------------|---|
| Austria | 67 408. Device for regulating the depth of tillage machines with rotary implements. |
| | 67 402. Device for coupling agricultural machines to their tractor. |
| Canada | 155 001. Motor plough. |
| | 155 071. Gang plough. |
| | 155 124, 155 488, 155 635. Cultivators. |
| | 155 137. Clod-crusher. |
| | 155 138. Traction belt for motors of the Caterpillar type. |
| | 155 139. Traction machine. |
| | 155 250. Plough with concavo-convex disk. |
| | 155 357. Reversible plough. |
| | 155 373. Weeding tool. |
| | 155 393. Pulverizer for soil. |
| | 155 412. Plough disk. |
| France | 470 503. Device for increasing the stability of balance ploughs. |
| Germany | 276 371. Ploughing machine with oscillating shares working backwards. |
| | 276 412. Tillage machine with rotating drum carrying spades. |
| | 276 446. Stone collector with elevator screen and conveyor. |
| | 276 447. Adjustable cleat for driving wheels of motor ploughs and the like. |
| | 276 684. Cultivator share. |
| | 276 828. Shaft with hoes for hoeing machine. |
| | 277 065. Device for pulling and steering implements, especially for agricultural purposes. |
| | 277 123. Device for lifting the chains of tillage implements attached to and drawn by levers. |
| | 277 473. Plough with beam that can be raised or moved sideways. |
| | 277 474. Tillage machine with oscillating spades driven by a crank shaft. |
| | 277 475. Device for lifting and lowering, by power, agricultural implements. |
| | 277 610. Driving wheel for agricultural machines with moveable cleats fastened to the inside of the tyre. |
| Switzerland | 66 441. Tillage machine. |
| | 66 443. Spades with adjustable blades. |
| | 66 863. Cultivator share. |
| | 67 056. Plough share. |

- United Kingdom 10 969. Thinning machine, cultivators.
11 270. Digging machine.
12 780. Detachable point for protecting the points of the mould-board share and landside plate of a plough.
- United States 1 106 603. Mechanically propelled plough.
1 106 722, 1 108 286, 1 108 319, 1 109 438, 1 109 661. Cultivators.
1 106 742. Caster wheel truck attachment for cultivators.
1 106 529. Motor plough.
1 106 389. Attachment for plough guards.
1 106 582. Plough beam.
1 107 173. Weeder for harrows.
1 108 600. Cultivator tooth.
1 108 261, 1 109 442, 1 109 813. Harrows.
1 108 787. Self-propelled ploughing machine.
1 109 076. Automatic guiding device for harrows.
1 109 095. Combined plough and cultivator.
1 109 535. Sulky plough.
1 109 063. Subsoiler.
1 108 909. Harrow tooth fastener.
1 109 084. Plough-lifting mechanism.
1 109 806. Gang plough.
1 109 756. Combined plough and fertilizer distributor.

Manure distributors, etc.

- Canada 155 182. Manure loader.
155 300, 155 418. Manure spreaders.
- Denmark 19 063. Liquid manure distributor.
- Germany 277 030, 277 477. Manure distributors.
- Switzerland 66 654. Manure distributors.
- United Kingdom 10 786. Apparatus for distributing insecticides, manures, etc., by means of an air blast.
11 588. Manure distributor to be mounted on ploughs.
- United States 1 108 263. Fertilizer distributor.
1 108 150. Manure spreader.
1 109 896. Straw spreading attachment for manure distributors.

Drills and Sowing machines.

- Austria 67 401. Sowing machine.
- Canada 155 059. Potato planter.
- Germany 276 303, 276 576. Potato planters with device for making holes.
276 866. Agitator wheel arrangement for drills.
277 066. Sowing machine in which the seed issues from holes in the side of the hopper.
277 201. Device for pressing and covering the seed, applied to drills.
277 029. Drill and dibble.
- Switzerland 66 656. Apparatus mounted on wheels, for sowing in heaps, with knives to remove weeds and shares to open furrows.
- United Kingdom 11 155. Potato planter.
12 844. Seed and like distributors.
- United States 1 106 737. Combined disk harrow and seeder.
1 106 373. Corn planter.
1 109 835. Corn planter.

- United States 1 107 044. Cotton planter.
 1 108 130. Seed planter.
 1 108 435. Furrow opener for corn planters.
 1 108 878. Planter.
 1 109 711. Drilling attachment for disk harrows.

Reapers, mowers and other harvesting machines.

- Canada 154 990. Motor harvester.
 155 017. Hop-gathering machine.
 155 032, 155 618. Mowing machines.
 155 149. Carrier for harvesters.
 155 179. Grain shocking machine.
 155 405. Draft mechanism for harvesters.
 155 600. Stacker hood.
- France 470 498. Improvements in horse rakes.
- Germany 277 124. Device for tilting and raising the cutter-bar in mowers.
 277 315. Cutter-bar for mowers.
 277 459. Scythe eye with adjustable excentric fastening.
- Switzerland 66 444. Mower with fore-carriage.
 66 445. One-horse side-delivery swathe rake.
 66 657. Device on mowers for cleaning the blades.
 66 864. Cutter-bar for mowers.
 66 865. Scythe.
 66 959. Apparatus for automatic loading of hay carts.
- United Kingdom 10 793. Grass box for mowing machines.
 11 508. Motor mower.
 11 582. Tedding attachment for mowers.
 12 397. Horse-rakes.
 12 586. Aprons for harvesting machines.
 12 766. Appliance for collecting and cocking hay.
 13 320. Harvesting machine.
- United States 1 107 083. Cotton harvester.
 1 106 652. Sheaf loader.
 1 108 536. Vertical mower.
 1 108 150. Mowing machine.
 1 109 525. Nozzle for cotton pickers.
 1 110 158. Cotton picker.
 1 109 711. Hay gathering and stacking machine.
 1 109 687. Harvester.
 1 109 897. Hay-rake.
 1 109 688. Corn harvester and husking machine.
 1 109 664. Hay pitcher.

Machines for lifting root crops.

- Austria 67 403. Device for holding beets in beet-topping machines.
- Canada 154 924. Potato digger.
- Denmark 19 249. Machine for loading beets.
- United States 1 106 668. Potato harvester.
 1 108 341. Combined beet puller and topper.

Threshing and winnowing machines.

- United Kingdom 12 828. Improvement in beater of threshing machines.
 13 082. Threshing machine.
- United States 1 109 428. Seed cleaner.

Other agricultural machines and implements.

- Austria 67 302. Butter worker with intermediate gear.
67 530. Lid for milk pails.
67 531. Butter presses.
- Canada 154 881, 154 882. Baling machines.
154 928. Churn.
154 979. Sheaf loader.
154 998. Milk cooling and bottling apparatus.
155 009. Tool handle.
155 153. Milk separator.
155 156. Tractor.
155 157. Sprayer for plants.
155 233. Butter moulding apparatus.
155 267. Milk can.
155 323. Rossing machine.
155 449. Fibre breaking machine.
155 643. Traction belt.
155 652. Animal trap.
155 658. Peat working machine.
155 727. Machine for sharpening millstones.
155 759. Baling press.
155 797. Hay press.
155 835. Poultry feeder.
155 842. Incubator.
- Denmark 19 062. Device for milking machines.
19 064. Machine for singling beets.
19 229. Apparatus for freeing animals in stables.
19 234, 19 280. Automatic straw presses.
19 273. Apparatus for heating milk for a certain length of time.
- France 470 945. Stand for drying hay.
- Germany 276 305. Apparatus with agitator for extracting wax from empty honey-combs.
276 448. Central cone for milk separators, formed of several rings kept together by adhesives.
276 577. Potato peeling machine.
276 641. Drum for milk separator.
277 067. Adjustable nozzle.
277 096. Incubator with automatic heat regulator, cooler and ventilator.
277 225. Apparatus for rendering milk and other liquids homogeneous.
277 381. Apparatus for catching insects.
277 476. Machine for excavating ditches, canals, etc.
277 575. Fore-carriage for agricultural machines.
277 576. Milk skimming pan.
- Switzerland 66 442. Appliance to keep agricultural machines mounted on wheels at the proper distance from the power machine.
66 446. Supports for strawberries.
66 447. Feeding trough.
66 448. Apparatus for untying cattle.
66 449. Cattle drinking trough closing automatically.
66 728. Curd-cutter.
66 961. Adjustable railing for feeding troughs in stables.

- United Kingdom 10 772. Machine for gauging and sorting corks.
 11 602. Milk cans.
 11 164. Propagation and seeding boxes.
 11 229. Hopper truck for spreading tea to be dried, fermented, etc.
 11 224. Appliance for gathering fruit.
 11 271. Traction engine.
 11 321. Shoots for conveying sacks.
 11 393. Luminous paint lamp-trap for insects.
 11 401. Horticultural frames.
 11 411, 11 513, 11 726. Cow-milkers.
 11 705. Machine for stemming tobacco leaves.
 11 931. Apparatus for hulling coffee, grinding maize, wheat, etc.
 11 977. Implement for tapping rubber trees.
 12 195. Apparatus for extracting oils by means of volatile solvents.
 12 141. Megasse furnaces.
 12 230. Baling press.
 12 414. Machine for cleaning and sorting potatoes.
 12 459. Machine for reducing oyster shells, spices, maize, etc.
 12 736. Animal traps.
 12 873. Combined incubating and rearing apparatus.
 12 984. Trap for flies.
 13 037. Separator for grain refuse.
 13 249. Sack holders.
 13 328. Churns.
 13 436. Rotary malting drum.
- United States. 1 107 001, 1 110 298. Tongue trucks.
 1 106 512. Hay carrier.
 1 106 405. Plant replanter.
 1 106 580. Hay press.
 1 108 203. Levelling device for traction engine.
 1 108 373. Ensilage machine.
 1 108 325. Stalk puller.
 1 108 163. Feeding device for feed cutters.
 1 108 579. Baled hay conveyor and elevator.
 1 109 456. Litter carrier.
 1 109 429. Farm tractor.
 1 109 294. Tractor wheel.
 1 108 882. Bug and worm collector.
 1 109 752. Wagon steering gear.
 1 109 789. Wagon loader.
 1 109 687. Seed germinator and plant forcer.

**BUILDING
CONSTRUCTION**

1163 - **Bold Concrete Dam.** — *Engineering Record*, Vol. 69, No. 25, p. 693. New York, June 20, 1914.

In 1907 a dam was built, on a firm lava rock, across the Crowley Creek in Idaho, U. S. A., for irrigation and domestic needs. It is 55 feet high and its plan is a curve of 72 feet radius, the convex side being turned up stream. It is of unreinforced concrete and only 5 ft. 2 in. thick at the base and 3 ft. at the top. It has been found very satisfactory as it has had more than a foot of water flowing over it on several occasions.

Recently it has become desirable to increase the reservoir capacity, and a State permit has been granted for the raising of the original structure to a height of 90 feet. The thickness at the bottom will be increased to 9 ft. 2 in. and at the top to 3 ft. 2 in. The length of the crest will be 223 ft. At its central point it will be 1 foot lower than at the wing walls, towards which the crest slopes gently upwards so that the overflow tends to concentrate at the centre, but in flood seasons the entire length between wing walls becomes a spillway.

When filled to the 90 ft. level, the reservoir will cover 66 acres to an average depth of about 36.4 feet, storing 2400 acre-feet.

RURAL ECONOMICS.

1164 - On the Selection of Crop Rotations. — MARENGHI, E., in *L'Italia Agricola*, Year 51, No. 10, pp. 436-438. Piacenza, October 1914.

1. In the application of economics to agriculture the various difficulties which interfere with the realisation of the maximum profit may be classed as *objective* and *subjective*. The former are due to certain external conditions quite independent of the ability of the person directing the enterprise. The inevitable divergence entailed by many systems of cultivation from the most suitable type, is often* due to the very specialised character of the land itself.

The possibility of re-organising agricultural exploitation is therefore subordinated, at least partly, to the special conditions prevailing. Generally, too rapid and radical changes are not possible, since they involve loss of capital invested in the soil. For example, although it would be comparatively easy to replace one herbaceous crop by another in a short time, it would be more difficult to extend the forage area and still more difficult to replace one kind of woody growth by another. Admitting that agricultural exploitation can be modified with relative rapidity, no state of equilibrium can be reached, owing to the inevitable dynamism of all the economic factors.

2. The *subjective* difficulties, on the other hand, are due principally to the incapacity of the farmer.

The systems of cultivation suffer always necessarily from the great difficulty of forecasting coming economic events, previsions never being confirmed by facts.

3. A system usually followed, and which enables serious errors to be avoided, consists in adopting from time to time only those methods which tend to prevail and which therefore are presumably sanctioned by experience.

4. The systems predominating in the different zones should be regarded as attempts of the cultivators to realise a maximum profit. Though it is true that this is never completely realised, the predominating or general

system in vogue should be regarded as the best organised and the most remunerative.

The data for the solution of this problem can be obtained from various sources, amongst others, the Land Register, which indicates the distribution of the various crops in the different districts. From an examination of the distribution of crops in the hills and plains of Perugia it has been possible to deduce a rotation which fairly illustrates the subject in question.

5. It is presupposed that the different combinations of crops differ in one sense or another from that giving the maximum return; but this supposition corresponds only approximately to the facts. It often happens that all or almost all the combinations in question are affected by the same error, especially where too much importance is attached to established usage. Even in this case, however, much valuable information may be obtained by observation of facts.

6. Analogous results are more often obtained by the data furnished by statistical observations during a single year and grouped according to the ability of the various cultivators, which may be excellent, mediocre or bad.

The system of cultivation adopted by the most capable agriculturists and which consequently approaches the most remunerative, is a suitable model for the particular conditions of situation and time. But in this case also some reserve is desirable; for though in general the most progressive systems should be followed, it sometimes happens that excellent agriculturists make the same collective error of economic forecasting.

As an instance of this the writer mentions the vine-growing crisis in Apulia several years ago.

Similarly, statistical observation of crop systems has only a very approximate practical value, since it can only provide rather vague and schematic indications, though in any case more trustworthy than the data given by analytical book-keeping. The latter method is only suitable as a help—in the most favourable case—for the solution of small questions of detail and not for the tracing with any reliability of the fundamental basis of rotation systems, which must be selected in the various practical cases.

1165 — **Statistical Data on the Economy of the Farms Belonging to the Cooperative Book-keeping Association of Königsberg in Prussia.** (1) — GÜNGERICH, in *Georgica*, Year 7, No 51, p. 437; No 53, pp. 453-454. Königsberg, June 25 and July 2, 1914.

During the year 1912-13 the average distribution of crops in the 145 farms belonging to the cooperative book-keeping association was as follows: 19.8 per cent of the cultivated area was under winter cereals, 18.8 under spring cereals, 3.6 under pulse, 6.5 hoed crops, 46.8 forage crops, 2.1 fallow, and 2.4 per cent miscellaneous.

The capitals invested in the farms since the year 1904-05, the first

(1) See No 927, *B.* August 1913.

(Ed.)

of the existence of the Association, have been, per acre of cultivated area, as follows :

Year	Number of farms	Buildings			Live stock			Dead stock		
		£	s	d	£	s	d	£	s	d
1904-05.	18	6	9	4	2	15	11 ¹ / ₄	0	17	5 ¹ / ₂
1905-06.	45	6	12	1 ¹ / ₂	2	17	11	0	17	10 ¹ / ₄
1906-07.	57	7	4	5	3	2	3 ¹ / ₅	0	18	3
1907-08.	70	7	4	5	3	3	1	0	18	3
1908-09.	74	7	8	4 ¹ / ₂	3	5	10 ¹ / ₄	0	18	7 ³ / ₄
1909-10.	89	7	10	4 ¹ / ₂	3	6	7 ³ / ₄	0	19	10
1910-11.	96	7	13	11 ¹ / ₄	3	5	5 ³ / ₄	1	0	7 ³ / ₄
1911-12.	118	7	15	6 ¹ / ₄	3	9	5 ¹ / ₄	1	1	9 ³ / ₄
1912-13.	145	7	1	3	3	17	9 ¹ / ₄	1	5	9 ¹ / ₂

The decrease in the value of buildings during the last year is due to the fact that the value of the owner's residence is deducted from the total value of the buildings. The sudden increase in the value of the live and dead stock in the last year is caused by having reckoned as cultivated area only the fields, meadows, and pastures, while in the preceding years a portion of the areas occupied by yards, roads, ditches, and other waste land was also included.

The figures for the individual farms vary according to the degree of intensity of the farming ; thus the capital in buildings ranges from about £4 to £12, that in live stock from £2 to £6, and that in machines and implements from £1 to £3.

If the figures for the individual farms be grouped according to the extent of the cultivated area, the following table is the result :

Class	Number of farms	Buildings			Live stock			Dead stock		
		£	s	d	£	s	d	£	s	d
Class I up to 617 acres .	34	7	9	2	4	10	6	1	16	1
" II from 620 to 235 acres	58	7	2	5	4	2	1	1	5	0
" III 1237 1852	31	6	17	3	3	3	6	0	17	6
" IV above 1852 acres . .	20	6	18	1	3	2	8	0	17	6

The average stock of live stock increased from about 16.6 head of large cattle per 100 acres of cultivated area in the year 1904-05 to 20.2

	Number of farms	Net profits	Returns	From live stock	From sale of produce	From Sundries	Outlay	Purchase of live stock	Manures Fodder	Salaries and wages	Upkeep of build- ings and imple- ments	Sundries in kind	Value of wheat used in pay- ments in kind
1911-12	118	1 89	4 10 10	2 85	1 14 11	0 7 6	3 4 3	0 13 6	0 9 6	0 17 3	0 5 11	0 11 6	0 5 4
Average of: period 1904- 05-1911-12	71	0 18 0	3 11 10	2 10	1 23	0 8 7	2 14 9	0 12 11	0 4 0	0 14 10	0 4 9	0 11 6	0 4 4
1912-13	145	0 15 8	3 18 2	2 11 2	0 19 10	0 7 2	3 5 1	0 12 4	0 7 6	0 19 10	0 5 7	0 9 11	0 5 2
Average of period 1904- 05-1912-13	79	3 16 2	3 12 7	2 21	1 11 0	0 8 7	2 15 11	0 12 8	0 4 4	0 15 6	0 4 9	0 11 6	0 4 4

£ s d per acre

head in 1912-13, while the number of draught animals has remained fairly constant at an average of 4.2 head.

The year 1912-13 closed with considerably lower net profits than the preceding year 1911-12, and has thus lowered the average of the net profits, as may be seen from the table opposite, in which the net profits and the total turnover per acre, as average of all the farms, for the years 1911-12, 1912-13 and the periods 1904-05-1911-12 and 1904-05-1912-13 are shown.

The value of these farms, calculated by capitalising the average net profits at the rate of 4 per cent, amounts to about £20 per acre, which is considerably below the prices paid now for farms; in other words, the net returns obtained represent a low interest on the capital invested. If the landowner is to have adequate interest on his capital and to pay his private expenses, such as interest on debts, taxes, housekeeping, etc., out of the returns of his property, without loss, the average net returns should be, according to the writer, increased to at least £1 per acre.

1166 - Comparative Cost of Food for a Heifer, Stall-fed or at Grass, up to her First Calving. — ZWANOWETZ, EDUARD, in *Wiener Landwirtschaftliche Zeitung*, Year 64, No. 68, p. 656. Vienna, August 26, 1914.

The writer works out as follows the cost of food for a cow at two and a half years, according as she has been exclusively stall-fed or has been put out to graze in summer. (She is supposed to have been calved on the 1st of November).

TABLE I. — *Cost of Food for Stall Feeding.*

1. Nov 1 to April 30, age $\frac{1}{2}$ year			
	£	s	d
132 gallons whole milk, at 8 $\frac{1}{4}$ d	4	10	0
220 lbs. crushed oats and oatmeal, at 6s 9d per cwt.	—	13	4
880 lbs. tender meadow hay, at £2 2s 6d per ton	—	16	8
880 lbs. mangolds, at 12s 9d per ton	—	5	0
	£	6	5 0
2. May 1 to Oct. 31, age 1 year			
814 lbs. oats, at 7s 8d per cwt.	2	15	6
1628 lbs. hay, at £2 2s 6d per ton	1	10	10
814 lbs. straw of spring grain, at 25s 6d per ton	—	9	3
3300 lbs. green fodder, at 8s 6d per ton	—	12	6
	£	5	8 1
3. Nov. 1 to April 30, age 1 $\frac{1}{2}$ year.			
405 lbs. rye bran, at 6s per cwt.	1	1	6
1210 lbs. dry fodder, at £2 2s 6d per ton.	1	3	0
1210 lbs. straw of spring grain, at 25s 6d per ton	—	14	0
4050 lbs. mangolds, at 12s 9d per ton	1	3	0
	£	4	1 6
Carried forward	£	15	14 7

Brought forward . . .				£ 15	14	7
4. May 1 to Oct. 31, age 2 years.						
202 lbs. rye bran, at 6s per cwt.	—	10	9			
16200 lbs. green fodder, at 8s 6d per ton	3	1	4			
405 lbs. straw of spring grain, at 25s 6d per ton	—	4	7			
	£	3	16	8		
5. Nov. 1 to April 30, age 2 ½ years						
405 lbs. rye bran, at 6s per cwt.	1	1	6			
814 lbs. dry fodder, at £2 2s 6d per ton	—	15	6			
1628 lbs. straw of spring grain, at 25s 6d per ton	—	18	6			
6070 lbs. mangolds, at 12s 9d per ton	1	14	6			
	£	4	10	0		
Total cost of stall feeding	£24	1	3			

TABLE II. --- *Cost of Food at Grass.*

1. Nov. 1 to April 30, age ½ year.	£	s	d
As in Table I	6	5	0
2. May 1 to Oct. 31, age 1 year.			
Pasture, 184 days at 3d	2	6	0
3. Nov. 1 to April 30, age 1 ½ year			
As in Table I but without bran	3	0	0
4. May 1 to Oct. 31, age 2 years			
Pasture, 184 days at 4d	3	1	4
5. Nov. 1 to April 30, age 2 ½ years.			
As in Table I, but without bran	3	8	6
Total cost at grass	£18	0	10

Thus the difference in favour of pasturing is £ 6 os. 5d.

1167 - **A Metayer's Family in Chianti (Tuscany).** — TASSINARI, G., in *Atti della Reale Accademia Economico-Agraria dei Georgofili di Firenze*, Series 5, Vol. XI, No. 4, pp. 283-310. Florence, October 1914.

In order to enable comparisons to be made with other monographs on this subject, the data in this monograph have been arranged according to the plan elaborated by LE PLAY. The metayer's family which is the subject of this study represents with fair approximation the average type of farmer in the Chianti district from the point of view of economic condition and moral and intellectual characteristics.

The holding is on hilly land and it comprises about 17 acres of arable land, with vineyard and fruit trees containing about 3500 vines, 207 olives, 30 fruit and other trees, and 87 acres of woodland and rather steep pasture.

The area under herbaceous crops comprises about 7 to 10 acres of wheat (10 acres being the maximum), 2 ½ acres under forage and 4 ½ acres under the first crop after deep cultivation, which may include maize, beans, potatoes, tomatoes, etc; broad beans, chick peas and lentils are also grown.

Sainfoin and a little lucerne are grown as forage crops, and barley, oats, vetches, beans, etc., are sometimes grown for the same purpose.

The manure used is chiefly dung, particularly from sheep; chemical manures are rarely employed.

The farm products (those from the woodland being excepted) and the profits on the live stock are shared equally with the landlord, who provides half the cost of the seeds required and pays the estate taxes. The taxes on live stock are shared by the tenant and landlord. The house, garden and fire-wood are regarded as free allowances to the tenant, and the landlord is charged with the cost of fungicides. The annual charges of the tenant are about 400 ft of trenches for vines, etc., and 10 head of poultry.

The family includes 6 persons: 4 men and 2 women. The live stock belonging to the farm includes: 2 oxen, 1 sow, 4 pigs, 37 sheep and 6 lambs, valued at £ 100; the dead stock leased includes forage, litter and manure valued at £ 43, implements valued at £ 12, wine vats and materials for other industries valued at £ 6: the total, including poultry, reaching about £ 145.

The furniture, utensils, linen and clothing of the family are estimated at about £ 68.

The family balance sheet is summarised as follows:

	£	s	d
Farm products, farmer's half-share	78	7	8
Other profits allowed in the contract	15	3	10
Total Receipts . . .	93	11	6
Expenses for permanent and temporary work, seeds, imple- ments, machines, etc.	20	9	3
Net Profit . . .	£ 73	2	3

The total family expenses consume £67 4s 2d per annum, leaving £5 18s more or less, which goes to increase the credit of the metayer with his landlord.

This corresponds to a share of annual earning of £18 14s 11d per worker and of £13 8s 10d per consumer of the family (1).

AGRICULTURAL INDUSTRIES.

1168 - The Origin, Quantity and Signification of Lactic Acid in certain Italian Wines. — MENSTO, C., and GARINO CANINA, E., in *Le Stazioni Sperimentali Agrarie Italiane*, Vol. XLVII, Part 6, pp. 385-409. Modena, 1914.

An attempt has been made to determine the quantity of lactic acid usually formed in some of the finest Piedmont wines as compared with the quantity in common wines; what are the conditions under which such formation takes place; what are the micro-organisms producing it; and what is its biological significance.

(1) This year's expenses have been increased owing to the military service of one of the sons, so that £15 figures in the account as outside labour.

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DEPENDENT
ON PLANT
PRODUCTS

The main results of the investigations are as follows:

1). Lactic acid is a constituent of all wines and may be present to the extent of 4 to 5 gms. per litre.

2). The amount increases gradually as the wine ages and though advantageous at first it may become distinctly injurious. In the case of many wines, e. g. Barolo, Barbaresco, Gattinara, malo-lactic fermentation is essential for the development of their organoleptic qualities. It is also of great importance for ordinary wines, especially those with a low percentage of alcohol.

3). This fermentation is due chiefly to micro-organisms analogous in shape and behaviour to *Bacterium gracile* of MÜLLER-THURGAU, which splits malic acid into lactic and carbonic acids but has no action on tartaric acid.

4) Malo-lactic fermentation causes a considerable decrease in the acidity of the wine.

5). "Turned" wines (containing decomposition products of tartaric acid and extractives which give rise to a disagreeable flavour and loss of the wine) are fortunately rare in Piedmont.

6) In testing wine for its origin, whether genuine or artificial, the determination of the lactic acid should never be neglected.

From a practical point of view it is important to remember that wine after a certain age should be considered as the product of two fermentations: the first and most important being the alcoholic fermentation and the second the malo-lactic fermentation. Wine makers should watch their wines with a view to increasing, preventing or retarding the decomposition of the acids according as it is desirable. The acidity may be diminished by retarding the racking, maintaining the cellar at a suitably high temperature, and avoiding the use of sulphurous compounds. The decomposition of the acids may be retarded by using sulphurous acid while making the wine, maintaining the cellar at a low temperature, and by the prudent repetition of the sulphurous acid treatment.

1169 — **Spanish Wines.** — DE LA ROSA, G. FERNANDEZ, in *Boletín de Agricultura técnica y económica*, Year VI, No. 67, pp. 622-626. Madrid, July 31, 1914.

According to the most recent statistics the area of vineyards in Spain is 3 396 460 acres, of which 1 891 160 are free from phylloxera, 1 047 420 have been reconstituted and 457 880 are infected and decadent, but still productive.

The methods of cultivation are, in many districts, antiquated and empirical. Propagation is by cuttings planted in holes and cultivation generally consists in ploughing, with hand-hoeing round each plant. Pruning is done annually and all the grapes are picked at once. In the best vine-growing districts, such as Jerez de la Frontera, Puerto de Santa Maria and Sanlúcar de Barrameda in the province of Cadiz, and several districts of the provinces of Malaga and Cordova, very different systems are practised. Before planting the vineyard the land is deeply trenched and thoroughly hoed over several times to aerate the soil; pruning, removing the surplus shoots and gathering the grapes are done at several times.

The best Spanish wines are the "finos" and "olorosos" of Jerez, "manzanilla" of Sanlúcar, muscatel of Malaga, "Pedro Ximenez" of Montilla, "pajarete" of Bornos, "tintilla" of Rota, "Cariñena" of Aragon (white wines); the wines of Alicante, Valdepeñas, Mudela and Calzada de Calatrava in the Mancha; those of "Priorato" in Catalonia; of Navarre and Rioja (red and rose-coloured wines).

The average annual production of grapes is 2 905 537 tons, of which 274 074 tons are used for direct consumption, and 2 631 464 tons are used for wine-making, producing 3 883 000 gals. of must. The average price has been 6s 2d per cwt. of grapes and 7.89d per gallon of new wine. The average annual value of the wine products amounts to £14 454 138, not including £530 063 for lees and vinasse. It should be pointed out that this value would be considerably increased if it were based on the value of the mature wine instead of on the must and on new wine only a few months old.

Notwithstanding serious difficulties, the cultivation of the vine and wine-making in Spain are always improving, chiefly through the influence of educational centres, among which should be mentioned the Oenological Stations of Haro (Logroño), Villafranca del Panades (Barcelona) and Reus (Taragon).

1170 - **The Wines of Istria.** — BUFALINI, D., in *Giornale Vinicolo Italiano*, Year 40, No. 37, pp. 865-867. Casale Monferrato, September 13, 1914.

Agricultural conditions in Istria are little known to the outside world. During the last 10 years very rapid progress in the wine industry has been made, and this still continues. Istria may be divided into the following six wine-growing districts:

1. The Karst with the district of Castelnuovo.
2. The eastern coast with the districts of Albona and Volosca.
3. The southern coast with the districts of Pola, Dignano, Rovigno and Parenzo.
4. The northern and north-western coast with Tirano and Campo-dustria.
5. The mountain region and high plateau of the interior with Pisino and Pingente.
6. The islands of the Quarnero: Cherso, Lussin and Veglia.

In a good year the total yield of wine in Istria reaches 13 200 000 gallons, of which nearly half is exported.

The local wines are as follows:

1. "Vino terrano" or "refoteo" from white lands, characterised by a deep red colour and pronounced acidity.
2. White wine without special character, made from grapes which also yield a considerable product: Isolana, Durania, Malvasia, Dinella, Treolina, Tebbiano, Drasanella.
3. "Vino rosato", rich in alcohol and with limited acidity, rose coloured with an agreeable flavour, obtained from grapes which always yield well: Rossara, Planiva, Negra tenera, Bontempa, Moretta, Pignoletta, Crenatizza.

4. White muscat made from the grapes of the same name, especially in the districts of Buie, Momiano, Verteneglio.

5. The rose muscat wines of Dignano.

6. Sweet and sparkling "Refoschi" wines.

The foreign varieties grown successfully on American stocks are: Traminer, Pinot, Malvasia, Rhenish Riesling, Semillon, Burgundy (large bunched variety), Cabernet, Chasselas, Früher von der Lahn.

The control of phylloxera by replacing the vineyards with American stocks has enabled the introduction of foreign stocks which improved the local varieties. The production of large quantities of wine of uniform quality, which formerly presented such difficulties, is now an accomplished fact.

The provincial cellar of Parenzo produces about 110 000 gals., those of Brioni and Buie from 220 000 to 264 000 gals., the social cellars of Rovigno and Cittanova 11 000 gals. Vine-growing is the principal, though not the only, resource of the land in Istria.

1171 - The Influence of Nitrogen Compounds on the Vulcanization of Rubber. —

— *The India Rubber World*. Vol. 4, No. 6, pp. 650-651. New York, September 1, 1914.

In the rubber industry it has not been until recently that the importance of small quantities of nitrogen compounds found in most rubbers has been recognized.

WEBER considered the protein contents of latex as "impurities" which may be eliminated by good coagulation.

Dr. DAVID SPENCE (*Journal of the Society of Chemical Industry*, 1907, p. 1287) investigated the distribution of protein in rubber and found that in the insoluble part there was sometimes as much as 5.4 per cent of nitrogen; this would mean about 33 per cent protein.

SCHIDROWITZ in 1911 noted that plantation rubber is usually deficient in nitrogen.

At the Eighth International Congress of Applied Chemistry held in New York in 1912, CLAYTON BEADLE and H. P. STEVENS described an investigation of *Hevea* latex. They found that the latices contained from 1.31 to 1.56 per cent protein; that the percentage of protein of the total solids varied from 5.1 to 5.5, and that about one half of this protein was retained in the washed and coagulated rubber in the form of dry crêpe. The same STEVENS in the *Colloid Zeitschrift* (Vol. XV, Nos. 1 and 2, pp. 36-49 and 86-96, Dresden and Leipzig, July, August, 1914), showed that the nitrogenous constituents had much influence, and the resinous constituents little influence on vulcanization.

CLAYTON BEADLE and H. P. STEVENS separated the protein matter which contained the nitrogen, from smoked sheet. (1) Then they vulcanized the nitrogenous part and the nitrogen-free part and the original sheet. It was found that the part of the rubber with high nitrogen contents vulcanized more rapidly and combined with more sulphur than the

(1) See No. 131, B. Feb. 1913.

(Ed.)

original sheet and that the nitrogen-free part combined with the least. The strength and resiliency of the nitrogen-containing part was the greatest.

The question then arises whether nitrogenous compounds may be added to rubber to act as hasteners of vulcanization or to give improved products.

In the *Gummi Zeitung* (Year 28, No. 19, p. 731, Berlin, February 1914) it is shown that albumen added to rubber increases the speed of vulcanization.

In the French patent No. 466 243, scrap rubber is heated with caustic soda and a small quantity of an aromatic amino compound, which acts as a catalyst to unite the free and combined sulphur with the alkali. In a German and English patent piperidine or its homologues are added to the vulcanizing masses; in another patent piperidine or its homologues are used for producing hard rubber by adding 25 per cent sulphur.

* In other patents the following substances are used: the derivatives or salts of piperidine, aliphatic amines with open or closed chains, the addition product of carbon disulphide and dimethylamine, aniline, naphthyl amine, a paste of albumen and lime.

Almost all the above-mentioned agents are organic nitrogen compounds, usually in the form of amines, and this authorizes the conclusion that this form of nitrogen has some catalytic influence in hastening the combination of rubber and sulphur, and in polymerizing the rubber itself.

With the use of large quantities of plantation rubbers which are known to be deficient in both proteins and other nitrogen compounds, and which are recognized as being much slower in vulcanization than Para, it would seem to be desirable to determine on some substance, like the above, which will act as a hastener.

1072 — **The Cause of Acidity in Fresh Milk of Cows and a Method for the Determination of Acidity.** — VAN SLYKE, L. L., and BOSWORTH, A. W. (New York Agricultural Experiment Station) in *The Journal of Biological Chemistry*, Vol. XIX, No. 1, pp. 73-76. Baltimore, Md., September 1914.

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The fact that milk is strongly alkaline to methyl orange would indicate that its acidity is due to the presence of acid phosphates of the type MH_2PO_4 . Now when phosphates are titrated with alkali in the presence of calcium salts, some of the insoluble dicalcium phosphate ($CaHPO_4$) formed during the titration hydrolyses, changing into calcium hydroxide and phosphoric acid, and then the calcium hydroxide unites with more dicalcium phosphate to form tricalcium phosphate, which appears as a precipitate. These conditions occur when the acidity of milk is determined in the usual methods with $\frac{N}{10}$ caustic soda, and the free phosphoric acid

formed increases the acidity as measured by titration.

Serum was separated from whole milk by filtration through a porous porcelain filter and the titration figure given by whole milk was about twice that obtained with the serum. This difference has been ordinarily interpreted as being due to the acidity of milk casein, but as the writers have some evidence that casein is present in milk in the form of a neutral com-

pound and the other constituents removed by the filter are fat and dicalcium phosphate, both of which are neutral to phenolphthalein, it would appear that the cause of the discrepancy is the removal of the dicalcium phosphate which permits the formation of phosphoric acid.

The writers therefore suggest that in estimating the acidity of milk samples, the calcium should be previously removed by treatment with a saturated solution of neutral potassium oxalate at the rate of 2 cc. per 100 cc. of milk.

1173 - **Ability of Streptococci to Survive Pasteurization.** — AYERS, S. HENRY, (Bacteriologist) and JOHNSON, WILLIAM T., JR. (Scientific Assistant, Dairy Division, Bureau of Animal Industry) in *Journal of Agricultural Research*, Vol. II, No. 4, pp. 321-330 + 3 diagr. Department of Agriculture, Washington, July 1914.

It is generally assumed that cocci do not form spores and the vegetative cells would not be expected to withstand Pasteurization. It has been shown, however, by the writer and others, that certain strains of lactic-acid bacteria, which would be classified among the streptococci, and perhaps some streptococci found in cream, are able to survive Pasteurization.

The writers have resumed the experimental study of the question and they summarize the results obtained as follows:

1. When the heating was performed in milk for 30 minutes under conditions similar to Pasteurization the thermal death-points of 139 cultures of streptococci isolated from cow feces, from the udder and the mouth of the cow, and from milk and cream, showed a wide variation. At 60°C. (140°F.) the lowest Pasteurizing temperature, 89 cultures, or 64.0 per cent, survived; at 62.8°C. (145°F.), the usual temperature for Pasteurizing, 46, or 33.1 per cent, survived; and at 71.1°C. (160°F.) 2.6 per cent of the cultures survived; all were destroyed at 73.9°C. (165°F.).

2. The streptococci from the udder were, on the whole, less resistant and those from milk and cream more resistant to heat than those from the mouth of the cow and from cow feces. When heated to 60°C. all of the 18 cultures from milk and cream survived; at 62.8°C. 17, or 94 per cent, survived; at 68.3°C. (135°F.) 9 cultures, or 50 per cent, withstood the heating process. All the streptococci from milk and cream were destroyed by heating to 73.9°C. for 30 minutes.

3. Among the 139 cultures of streptococci there were 22 that formed long chains and were considered (following the practice of some board of health laboratories) as typical streptococci. The others were considered atypical. (The writers, however, do not believe the chain formation a proper basis for classification). Of the 22 typical streptococci, 12 survived heating for 30 minutes at 57.2°C. (135°F.), 9 at 60°C. and only 1 at 62.8°C. All of the typical streptococci were destroyed at 65.6°C. (150°F.).

The 117 atypical streptococci were more resistant; at 60°C. 68.4 per cent survived, at 62.8°C. 38.5 per cent survived, and at 71.1°C. 2.5 per cent survived; all were destroyed at 73.9°C.

4. Two classes of streptococci seem to survive Pasteurization:

- a) Those which have a low majority thermal death point but among which a few cells are able to survive the Pasteurizing temperature. This

ability of a few bacteria to withstand the Pasteurization temperatures may be due to certain resistant characteristics peculiar to a few cells, or may be due to some protective influence in the milk.

b) Streptococci which have a high majority thermal death point. When such is the case the bacteria survive because the majority thermal death point is above the temperature used in Pasteurization. This ability to resist destruction by heating is a permanent characteristic of certain strains of streptococci.

5. The thermal death point determinations in this work were made in milk in such a manner as to represent actual conditions of Pasteurization by the holder process; consequently the results show what may be expected in commercial Pasteurization, and it is evident that some streptococci may survive the process. However, different results might have been obtained if a larger number of cultures had been studied and if other methods and media had been used for determining the thermal death points.

1174. — **Action of Bacteria on the Ripening and Flavour of Cheese of the Cheddar Type.** — I. — EVANS, ALICE C. (Bacteriologist, Dairy Division, Bureau of Animal Industry), HASTINGS, E. G. (Bacteriologist, Wisconsin Agricultural Experiment Station) and HART, E. B. (Chemist, Wisconsin Agricultural Experiment Station). Bacteria Concerned in the Production of the Characteristic Flavour in Cheese of the Cheddar Type. — *Journal of Agricultural Research*, Vol. II, No. 3, pp. 167-192. Washington, June 15, 1914. — II. — HART, E. B., HASTINGS, E. G., FLINT, E. M. (Chemist, Dairy Division, Bureau of Animal Industry) and EVANS, ALICE C. Relation of the Action of Certain Bacteria to the Ripening of Cheese of the Cheddar Type. — *Ibid.*, pp. 193-216.

I. — This is a continuation of previous investigations (1) consisting 1) in many bacteriological analyses of cheeses in order to determine more fully the distribution of the groups of bacteria in ripening cheese; 2) in a detailed study of the pure cultures obtained, with the view of correlating the presence of certain types with desirable or undesirable flavour production.

In the previous work the pure cultures were obtained by isolation from lactose-agar plate cultures and from dilution cultures in sterile milk. In the present study the dilution cultures were made in milk to which was added 1 gram of peptone, 1 gram of dextrose and 200 cc. of water per litre. This was found to be more favourable for the development of some of the cheese organisms. An effort was made to obtain two pure cultures from each series of dilution cultures: *viz.* the predominating organism of the *Bacterium lactis acidi* and coccus groups, and the predominating organism of the *B. casei* group. The former was obtained by plating — in casein agar to which 1 per cent. of dextrose was added — the culture from the highest dilution of the cheese which shows a growth after two days incubation; the latter was obtained after three weeks' incubation. On every plate a portion containing 10 colonies was circumscribed, and the inclosed colonies were fished off into litmus milk.

(1) See No. 868, B. July 1913.

(Ed.)

Those cultures from a single plate which caused the same changes in litmus milk and were of the same morphology, were considered of the same variety. Representatives of every variety were studied in detail. This method, which allows the examination of a large number of cheeses and gives a rough picture of their flora, was considered the best adapted to increase present knowledge on the subject.

The cultural characteristics, morphology, and the few biochemical reactions which are ordinarily considered in classification of bacteria, were found to be inadequate for distinguishing one variety of cheese organism from another of the same group. Therefore the system of classification based upon the fermentation of various test substances, used by Gordon and others, was adopted.

The results obtained by the writers are summarized as follows: The organisms constantly found in Cheddar cheese in such numbers as to indicate that they must function in the ripening process are included in four groups: *Bacterium lactis acidii*, *B. casei*, *Streptococcus* and *Micrococcus*. On the basis of the fermentation powers, each of the four groups may be divided into a number of varieties, the distribution of which in Cheddar cheese, prepared from both raw and pasteurized milk, has been studied. The flora of raw-milk cheese includes all the varieties into which the groups were divided. The flora of pasteurized milk cheese, with the exception of the *Bacterium casei* group, is dependent upon the flora of the starter. It seems that the pungent taste that develops late in the ripening period of both raw-milk and pasteurized milk cheeses is due to the *Bacterium casei* group. It is probable that growth of this group continues during the major part of the ripening period. The action of two or more organisms growing together is not the sum of their individual actions when growing alone. When growing together they may attack substances that neither can attack alone, or they may produce a larger quantity of acid than the sum of the quantities that either can produce alone. When added to pasteurized milk, the organisms of the *Bacterium casei* group produce a sour taste in the cheese during the early part of the ripening period. No Cheddar flavour is obtained in pasteurized-milk cheese when the organisms of the *Bacterium lactis acidii* group alone are used as starters. The varieties that are able to ferment the more complex substance are likely to produce a bitter taste.

Starters composed of both *Bacterium lactis acidii*, *b*, and *Streptococcus*, *b*, when added to pasteurized milk, improve the quality of the cheese. It does not seem unreasonable to hope that starters may be obtained that will give the characteristic Cheddar flavour to the cheese prepared from pasteurized milk.

II. — In a preliminary investigation of the non-nitrogenous constituents of Cheddar cheese, the very pronounced differences that were expected in the quantity and variety of volatile acids, esters and alcohols in good and poor types of cheese were not found. But since there were certain differences which could be only of biological origin, it was believed essential that the substances formed by the specific groups of organisms normally present in cheese should be more carefully studied. It was thus hoped to find

the groups of organisms to which the production of definite non-nitrogenous compounds that could be correlated with flavour production might be attributed. The compounds particularly sought were the alcohols and esters, and caproic and butyric acids. Formic, acetic, propionic, lactic and succinic acids were also included in the list of substances to be isolated. To some extent the sources of these bodies were also studied.

The writers summarize as follows the results of their very numerous and detailed experiments:

1. Representatives of the coccus groups of organisms isolated from Cheddar cheese, when grown in milk, produced large quantities of the volatile acids, particularly acetic acid. These acids were produced from citric acid or lactose or protein, as the medium was practically free from fat. These organisms did not produce formic acid. As they are present at times in very large numbers in cheese, they no doubt produce much of the volatile fatty acids which arise during the ripening process.

2. One of the strains of *Streptococcus b* was found to produce comparatively large quantities of alcohols and esters — bodies which contribute in a large degree to the flavour of cheese.

3. A dilute solution of acetic acid and alcohol formed esters by mere contact, without bacterial action.

In cheese, however, the dilution is probably too great for this manner of ester formation.

4. Lactic acid was generally not formed by the coccus groups.

5. The representatives of the *Bacterium casei* group examined, gave results differing from those obtained from the coccus forms. They produced no formic acid, but did form some propionic and much acetic acid.

6. These organisms produced a large quantity of lactic acid, both active and racemic, and decomposed the citric acid of the media.

7. Cheese made from chloroformed fresh milk did not yield any volatile fatty acids, showing that inherent milk enzymes are not capable of producing these bodies in any appreciable quantity.

8. Representatives of both the coccus and *Bacterium casei* groups were able to produce ammonia from milk.

9. Whey and fresh curds contained active lactic acid. Cheese one day old contained a mixture of active and racemic lactic acids.

10. The cause of the disappearance of active lactic acid and the appearance of racemic acid may be due to enzymic action, combined with the action of those bacteria which can produce both kinds of acid.

11. Some representatives of the *Bacterium casei* group produced levo-lactic acid and others dextro-lactic acid from milk. A mixture of these two varieties produced racemic lactic acid. A mixture of *B. lactis acidii* and a levo-producing member of the *B. casei* group gave racemic and active lactic acid. The active acid was probably the result of the longer continued activity of *B. casei*.

12. Racemic lactic acid found in curing cheese may therefore be produced in a small degree by enzyme action, but more probably by

the combined action of *Bacterium lactis acidii* and the organisms of the *B. casei* group.

- 1175 - The Part Played by Micro-organisms in the Ripening and in the Production of the Pungent Flavour of Brindza, the Ewes' Milk Cheese made in Hungary. — GRATZ, O., and VAS, K. (Experimental Dairy at Magyaróvár). — I. The part played by micro-organisms in the ripening and in the production of the pungent flavour of Brindza. — *Kísérleti Állattenyésztés és Állatorvoslás*, Vol. XVII, Part 3, pp. 347-394. Budapest, May-June, 1914. — II. On some new species of micro-organisms found in Brindza. — *Ibidem*, Vol. XVII, Part 1, pp. 635-644. Budapest, July-August 1914.

I. — The making of Brindza cheese differs essentially from that of other cheeses in that it is formed by kneading together several balls of curd prepared in different ways in different localities and under different conditions (1). The kneading, which is chiefly carried out in factories, undoubtedly causes a transformation of the bacterial flora and of the conditions of the enzymes in the paste of the balls. The objects of the present study are: 1) to determine the bacterial flora of Brindza and its qualitative and quantitative changes during the ripening of the stored cheese; 2) to identify the organisms which produce the pungent flavour in Brindza and to explain its presence; 3) to draw useful conclusions from the results obtained so as to improve the methods of making this cheese.

The experiments were made with five samples of fresh Brindza (some weeks old), which were subjected to control lasting six months. The bacteriological analyses were made at intervals of from 4 to 6 weeks.

The writers drew from their research the following conclusions:

1. The bacterial flora of Brindza is very varied. It includes *Micrococcus*, *Sarcina*, *Streptococcus*, *Bacterium*, *Bacillus*, *Actinomyces*, *Torula*, *Oidium*. Among the species isolated, there are several which have not hitherto been described in the literature on the subject. This great variety of microflora is to be attributed not only to the want of cleanness of the ewe's milk and to the bad rennet (made with water and easily liable to putrefaction), but also to contamination, during the making, due to the crust of the balls, the salt, the machines and implements.

2. Brindza is very rich in micro-organisms. There is no cheese with so high a germ content as Brindza, notwithstanding the fact that after it is made and during storage the multiplication of micro-organisms ceases. Most of these are lactic bacteria, especially *Bacterium casei*, *Streptococcus lactis*, *Micrococcus*; nevertheless, though very numerous (61 per cent), they do not attain the proportion that they reach in other cheeses (79 to 95 per cent). The cause of this is in the difference of manipulation, as compared with other cheeses, which introduces a large number of accidental germs and thus reduces the number of lactic bacteria.

3. The accidental micro-organisms, the presence of which is very instant, disappear soonest. Quantitative analyses have shown that during storage the content of germs in Brindza diminishes. At first the decrease is very marked, while later it slackens. Streptococci and cocci die much

(1) See No. 1669, B. Dec. 1912.

sooner than lactic bacilli, which are found together with their spores even in very strong Brindza.

4. Research has shown that the accidental micro-organisms do not take part in the ripening of the cheese, because its conditions do not favour either their development or the activity of their enzymes. The agents which cause ripening are therefore the lactic bacteria; nevertheless the enzymes of the rind of the curd balls also play an important part in the ripening of Brindza.

5. Results have demonstrated that the origin of the piquant flavour of some ewes' milk cheeses is due only in exceptional cases to butyric fermentation, and generally to a great decomposition of the fatty matter. This decomposition is not caused by the bacteria having the power of attacking fatty matter; this is proved by the fact that they have often been found in greater numbers in sweet Brindza than in strong pungent Brindza.

6. The agents of the great decomposition of fatty matter are enzymes and in the first place the lipase of *Oidium lactis*. The result is that if the outside of the curd balls (rich in butyric ferments and on which *Oidium lactis* is always present) and the fat layer under this outside (in which the enzymes are found) are not carefully removed when the cheese is worked up again, as is often the case, the above parts come into contact with the whole of the kneaded paste and communicate a pungent flavour to the cheese.

7. Observations made during the process of ripening have shown that strongly flavoured Brindza has a pale orange colour; it is dry, subject to crumbling, strongly smelling and never turns mouldy. On the other hand sweet Brindza has generally a normal consistence, but it becomes sticky and mouldy if it is not kept hermetically closed.

As for the practice of the manufacture of Brindza, the results of observations may be summarized as follows. It is not essentially necessary that Brindza should have a pungent flavour, because the origin of this flavour is not due to the action of micro-organisms the presence of which could not be avoided by the cheese-maker, but to the manipulation allowing the lipolytic enzymes existing on the rind of the balls to exert their influence, which fact had not hitherto been recognized. Knowing the factors which give Brindza this special taste, the cheese-makers will be able to modify it by adopting a suitable process of manufacture (careful removal of the rind of the balls).

The paper contains bibliographical notes, as well as diagrams and tables showing numerical results of the analyses made.

II. — Description of some new species of micro-organisms found during the research on the flora of Brindza and the part they play in the ripening and production of the special flavour of this cheese. Considering the various properties of these bacteria observed during their culture, and their biochemical action, they do not resemble any of the micro-organisms known so far to the literature of bacteriology. These new species are: *Bacterium saponificans*, *Bact. adipis*, *Bact. rufum*, *Bacillus gravidus*, *Bac. submergens*, *Bac. exilis*, *Bac. cerasinus*, *Bac. parabutyricus*, *Bac. indolicus*.

1176 — The Phosphorus Content of Casein. — BOSWORTH, A. W., and VAN SLYKE, L. I., (New York Agricultural Experiment Station) in *The Journal of Biological Chemistry*, Vol. XIX, No. 1, pp. 67-71. Baltimore, Md., September 1914.

The amount of phosphorus in casein has been commonly given as about 0.85 per cent. By treating a solution of casein in excess of dilute ammonia with ammonium oxalate and letting it stand twelve hours, the phosphorus content is reduced to 0.71 per cent. This lower percentage cannot be explained as being due to hydrolysis of casein and splitting of phosphorus, for though some of the casein is hydrolysed, the hydrolysed portion does not enter into the final preparation or affect its composition. The higher figure ordinarily given is due to the presence of inorganic phosphorus (dicalcium phosphate) carried from the milk into the precipitated casein and not entirely removed under the usual conditions of preparation. The lower figure corresponds very closely to two atoms of phosphorus in the casein molecule. Analyses of various preparations of casein containing varying amounts of ash show a general correspondence between the ash and phosphorus content.

1177 — A Comparison between the Fat Stock and the Carcasses Exhibited at the Smithfield Show, 1913. — LONG, JAMES, in *The Journal of the Board of Agriculture*, Vol. XXI, No. 1, pp. 1-12. London, April 1914.

The Smithfield Club holds each December a show of pure and cross-bred fat cattle, sheep and pigs. In 1896 a new section was added to the Smithfield show, for the best carcasses of beef and mutton, and this competition has continued ever since. In 1903 classes for pigs were added to the carcass section.

In the last competition the judges showed a decided preference not only for lean meat but also for small meat, and this applies to the carcasses of cattle and sheep as well as to pigs.

From the difference between the live-weight and the carcass-weight it appears that the younger the animal matures and can be finished for slaughter, the smaller will be the cost of producing a pound of meat, the better its quality and the smaller the waste.

In the 1896 carcass competition the two-year-old steers averaged 1323 lb. live-weight and 864 lb. in the carcass, or 65 per cent.

The average live-weight of steers under two years old is 1363 lb. Omitting the Highland cattle, the average weight in the class from 2 to 3 years is 1772 lb., which exceeds the former by 409 lb., or an estimated difference in the carcass-weight of 266 lb. This shows that it cannot pay the feeder to keep a steer for the additional year, since the actual weight of beef produced barely exceeds 5 lb. a week. The estimated carcass-weight of the steers under two years old is 886 lb., or 80 lb. more than that of the prize steers in the carcass class, while for steers between two and three years old, this estimated average is 1136 lb., or 282 lb. more than the actual average carcass-weight of the whole class. This difference represents much additional fat, that is, a factor which depreciates the unit of weight of the meat.

In the classes for heifers similar results are obtained. The average live-weight of the older animals is only 1576 lb., against an average of 1322 for the younger ones, showing an increase for one year of only 254 lb., which is reduced to 165 lb. of carcass. It is evident that this cannot pay. The accompanying tables show the weights observed :

TABLE I. — *Average live-weights of pigs exhibited in 1913.*

Breed	Under 9 months		9 to 12 months	
	Live-weight	Estimated weight of carcass	Live-weight	Estimated weight of carcass
	lb.	lb.	lb.	lb.
Berkshires	335	268	400	320
Tamworths	314	250	476	380
Lincolns	402	321	469	376
Large Whites	383	306	490	392
Middle Whites	302	241	400	320
Large Blacks	396	316	508	406

TABLE II. — *Average live and carcass weights of sheep exhibited in 1913.*

Breed	Open classes	
	Live-weight	Estimated carcass-weight
	lb.	lb.
Long-wool lambs	172	94
" wethers	248	142
Short-wool lambs	177	99
" " wethers	244	146
" " crosses, lambs	187	108
" " " wethers	172	99
Cheviot and Mountain	299	180
1st cross lambs	164	90
" " wethers	239	136
Cheviot lambs	152	83
" wethers	237	136
Suffolk lambs	200	112
" wethers	239	143
Southdown lambs	137	78
" wethers	191	108

Prize lots	Carcass Classes	
	Live-weight	Actual carcass weight
	lb.	lb.
Long-wool lambs, all Cheviots	115	63
» wethers, all Cheviots	138	79
Short-wool lambs, Southdowns	95	54
» » Suffolks	134	75
» wethers, Southdowns	122	69
Other short-wools, wethers	160	98
Cross-bred lambs	120	58
» » wethers	164	98

TABLE III. — *Average live and carcass weights of steers and heifers, exhibited in 1913.*

Breed	Open classes			
	Under two years		From two to three years old	
	Average live-weight	Estimated carcass-weight	Average live-weight	Estimated carcass-weight
	lb.	lb.	lb.	lb.
<i>Steers.</i>				
Devons	1 290	839	1 803	1 172
Herefords	1 419	922	1 978	1 286
Shorthorns	1 483	964	1 873	1 217
Sussex	1 356	881	1 826	1 187
Red Polled	1 320	858	1 492	970
Aberdeens	1 352	879	1 760	1 144
Galloways	1 231	800	1 672	1 087
Welsh	1 391	904	1 722	1 119
Crossbred (1st cross)	1 421	924	1 925	1 251
» (2nd and 3rd cross)	1 368	889	1 667	1 084
<i>Heifers.</i>				
Devons	1 351	878	1 598	1 039
Herefords	1 298	844	1 556	1 011
Shorthorns	1 336	868	1 606	1 044
Sussex	1 372	892	—	—
Aberdeens	1 249	812	1 627	1 058
Crossbred (1st cross)	1 269	825	1 709	1 111
» (2nd and 3rd cross)	1 383	899	1 642	1 067

Carcass class	Average live-weight	Actual carcass-weight
	lb.	lb.
Prize steers under two years	1 226	806
„ „ from two to three years old (the whole class)	1 330	854
„ Heifers under two years (eight animals including the winners)	1 146	747
Prize heifers from two to three years (Shorthorn-Aberdeen)	1 382	924

1178 - "Quality" in Wool. — BAILEY, P. L., and ENGEDOW, F. L., in *The Journal of Agricultural Science*, Vol. VI, Part 3 pp. 349-370. Cambridge, September 29, 1914.

NATHUSIUS, BOHM, KONIGSBOM, BOWMAN, MC MUTRIE and others have shown that "quality" in wool depends upon several factors, including

- 1) Fineness of fibre as measured by the average diameter.
- 2) Number of crimps or waves per unit length of the fibre.
- 3) Length.
- 4) Lustre.

The writers of this paper determined to repeat the work of the above writers and to subject the results to a statistical analysis. They studied the fleeces of crosses of Shropshire ewes with Australian Merino rams. They examined over 700 microscopic slides and made about 30 000 measurements. The present paper deals in particular with the relation between "fineness of fibre" and the commercial grading of the wool.

At shearing, samples were taken from both of the shoulders, the neck, the britch and the belly. A skilled Bradford sorter divided this wool into eight classes indicated by numbers 64's to 40's, which are based on the spinning capacity of a given weight of wool.

For the microscopic investigation, four sub-samples, A, B, C, D, were taken from each sample; from each sub-sample three portions were cut off, one at the tip end (T_1), another from the middle (T_2) and a third from the base (T_3). Each portion was placed on a glass slide and fixed with balsam. The measurements were made with a micrometer eye-piece, each division of the scale representing $\frac{1}{8000}$ of an inch. The figures in this paper are, unless otherwise stated, based upon a unit of measurement equal to one eye-piece-scale division.

The results and conclusions may be summarized as follows:

1. The method of taking four sub-samples and making in all 160 measurements of them gives a satisfactory value for the average diameter of the sample. The amplitude of the variation of the probable errors is given by the range 0.064—0.154 or, as percentages of the averages concerned, 1 to 1.6 per cent. Thus, if the largest magnitude of the probable error be taken, the odds are 20 to 1 that the average of 160 measurements is correct to within 5 per cent.

2. The average of the samples from each shoulder gives a good indication of the shoulder for each sheep. From a study of four cases showing exceptional fluctuation in the averages of the sub-samples it appeared that the probable error was 0.263 units, or a little over 3 per cent of the average. Consequently, even in cases of the greatest variability, one can rely upon the average obtained from the sub-samples representing the whole shoulder average to within 10 per cent. In the great majority of cases it will be correct to within 5 per cent.

3. In comparing two sheep, A and B, we may take as almost certainly significant a difference between their two average shoulder diameters such that the ratio

$$\frac{M_A - M_B}{\epsilon_{AB}} > 3,$$

that is a difference of some 8 per cent of the average shoulder diameter of either of them for measurements taken as here indicated. In other words, if the averages of the shoulder samples of two sheep differ by more than three times the standard error (1) of their difference, one may be satisfied that this difference is real and not due to any small variations in the position on the individual sheep from which the shoulder sample was taken.

4. A relationship exists between the fineness of the wool (as measured by the average diameter) and the commercial quality into which the wool is graded. But this relationship is not absolute. Thus, sheep that had suffered from a *Strongylus* attack, produced finer wool during the illness, so that the fibre presented a line of weakness with decrease of diameter. In such cases the average diameter is smaller and yet the commercial quality is inferior.

There is a correlation between the fineness of wool and the number of crimps per inch, but this appears to cease after the number has reached about 23 per inch.

5. The average diameter at the tip is the best guide from a genetic point of view as to the fineness of the wool concerned, owing to the marked pathological influences which may affect the base average.

6. The distribution of the fibres of different sizes has a modifying effect upon the commercial quality which would be assigned from a consideration of the average size only. It is suggested that the standard deviation of the distribution of the fibres should be used as a measure of this modifying effect.

In the accompanying table are given the "qualities", the average diameter sizes (M) of the fibres in those qualities and the standard deviations (σ) of the distributions. An examination of the figures there given shows that in the case of T_1 there is a distinct parallelism between the quality assigned by the sorter to the sample and the standard deviation of that

(1) See C. B. DAVENPORT: *Statistical Methods*, 1904; also R. LOCK: *Recent Progress in the Study of Variation, Heredity, and Evolution*, London, 1911 (chapter on Biometry, pp. 80-120).

(Ed.)

sample, a fall in "quality" being accompanied not only by a rise in the average diameter size, but also by a rise in the standard deviation. This latter rise cannot be explained as being wholly due to the rise in the average diameter, as is shown by the fact that there is also a rise in the coefficient of variation $\frac{\sigma}{M}$.

In order to study more closely the question of influence of variability of sample on the commercial quality, the percentage occurrence of diameters of every size was calculated for all the qualities. From the Table of the numerical results the qualities are seen to group themselves into four classes:

Class I: the 60's and 58's. The fibre distributions for these two qualities are much alike and show a comparatively small dispersion.

Class II: the 56's. The distribution for this class is of the same general nature as that of the preceding class, but shows a distinctly greater dispersion.

Class III: the 54's and 50's. The distribution appears to be bimodal, and the range of variability is much increased.

Class IV: the 44's. Fibres distributed in two or three modes and tending to coarseness.

The writers make some reserves on the generalization of their results, owing to the hybrid nature of the sheep from which the samples came.

Quality	T ₁ Average Diam.		T ₂ Average Diam.		T ₃ Average Diam.		T ₁ +T ₂ +T ₃	T ₁ +T ₂
							3	2
	M	σ	M	σ	M	σ	M	M
60's	8.11	1.47	8.11	1.52	5.41	1.25	7.21	6.76
58's	7.68	1.88	8.03	3.19	6.18	1.59	7.30	6.93
56's	8.28	1.92	8.28	1.84	7.16	1.70	7.91	7.72
54's	9.44	2.35	9.03	2.26	6.81	1.86	8.43	8.13
50's	8.93	2.19	8.83	2.21	6.92	2.45	8.23	7.93
44's	9.61	3.51	8.07	2.71	6.04	2.87	8.21	8.28
40's	8.36	2.11	8.18	2.37	6.18	1.92	7.57	7.52

1179 - **Libyan Hides and Skins.** — Industrial Experiments on Sudanese and Libyan Hides and Skins (From a Report of the Director of the Royal Experiment Station of the Leather Industry at Naples) in *Ministero delle Colonie, Ufficio economico, Bollettino di Informazioni*, Year II, No. 7-8, pp. 531-535. Rome. July-August 1914.

The production of cattle in Tripoli ania amounts annually to about 50 000 head. The animals are somewhat small, and weigh, on an average, 660 lbs. The salted and dry hides of adult animals received from Tripoli by the Royal Leather Experiment Station at Naples, weigh on an average 21 lbs.; the calf skins weigh 6 lbs., while those from Cyrenaica weigh respectively 15½ lbs. and 6½ lbs.

The hides from Cyrenaica were better than those from Tripolitania and more carefully sorted. In general, the products of both places were fairly good, being soft and of equal body and substance. They, however, had some easily eliminated defects (imperfect flaying and preservation, brand marks, etc.) and some were perforated by warbles.

Goat breeding is extensively practised in Tripolitania. The goats are of medium size, with black or reddish hair; their tails are small and little covered with hair. The height of the withers is from 2 ft. to 2 ft. 2 in. Beneath the hair is a wool which the natives weave into materials for local use. A goat weighs about 66-88 lbs. and the kids, which are sold when very young, weigh from 11 lbs. to 15 $\frac{1}{2}$ lbs. During the four months July-October 1913, 63 417 lbs. of untanned goatskins were exported from Tripoli and neighbourhood. The goatskins received from Cyrenaica and Tripolitania by the Royal Experiment Station at Naples are well suited to working *à chevreaux*, according to the English system of *semi-chromo* (tanning with gambier and a basic solution of chromium), for the preparation of a special leather "Dongola" (tanned with alum and gambier), and for cheap Morocco (tanned with sumach, gambier and quebracho and dyed with anilin colours). The goatskins of Tripolitania and Cyrenaica have proved to be of good quality and sufficient substance, without too much waste.

About 100 000 sheep are exported from Tripolitania. These animals belong to three species. The Orfella thin-tailed breed, the fat-tailed Gebel sheep with short legs, and the large Sudan animal which is without wool. In Tripoli medium-sized fat-tailed sheep are very plentiful. Their fleeces would be thick and uniform if they were well kept; but frequent skin diseases cause a partial loss of wool. The average weight of the Tripoli sheep is about 84 lbs., that of the rams is 88 lbs., while lambs 4-6 months old weigh 40 lbs., and those over a year old attain a weight of from 62 to 66 lbs. During the four months July-October 1913 about 117 115 lbs. of lamb and sheep skins were exported from Tripoli. The sheepskins received by the Royal Experiment Station at Naples were tanned as follows; 1) with the wool, for carpet leather; 2) for glove skins, from which excellent goods were obtained.

Libyan camel skins are not very important articles, as they are only sold when the animals are killed because they are past work, or when they die a natural death. From July-October 1913 about 11 365 lbs. of camel skins were exported from Tripoli. They are very irregular in shape and very defective. When tanned, they fetch barely £1 8s 3d per cwt. The inferior skins can be used for second quality sole-leather; those tanned with chromium serve for making lacings and straps.

AGRICULTURAL
PRODUCTS:
PRESERVING,
PACKING,
TRANSPORT,
TRADE

1180 - Experiments on Storing Swedes during the Winter, in Denmark. —

58. Meddelelse fra Statens Forsøgsvirksomhed i Plantecultur. Ved. Statens Planteavlsudvalg, Copenhagen, October 2, 1914 (Communicated by the Danish Correspondent of the International Institute of Agriculture).

The experiments were carried out during the four winters from 1909 to 1913 in the farms belonging to the Experiment Stations of Studsgaard, Varde and Holstebro.

Similar experiments made in 1906 showed that when mangolds were kept in large broad pits covered with seaweed and in field clamps, the loss in dry matter during the winter was not so great as when they were kept in cellars. The experiments which have now terminated show that the same holds true for swedes.

With a crop of swedes containing $59\frac{3}{4}$ cwt. of dry matter per acre, the losses were 7 cwt. of dry matter when they were kept in large pits till the middle of March, 8 cwt. in field clamps, and upwards of $13\frac{1}{2}$ cwt. when they were kept in cellars.

The loss with swedes is somewhat greater than with mangolds, and this is especially noticeable after the month of January. The cause of this lies in the fact that towards spring the loss caused by rot in the swede pits is much greater than in the mangold pits, and besides this, the direct loss of dry matter due to the vegetative activity of the roots seems to be greater in swedes than in mangolds.

In the choice between pits and clamps it must be borne in mind that the pits, besides causing a somewhat smaller loss during the winter, have also the advantage of being cheaper to cover and uncover than the clamps. On the other hand frost gets into pits more easily than into clamps; when no heather, seaweed or other suitable material is easily available, then clamps are to be preferred to pits. The experiments have shown that the winter losses in clamps are smaller when the ends are covered at once and the top only in December, unless continued frost should render this necessary sooner. The sides of the clamps were covered with earth and the top with heather.

The higher the temperature in the pit, the greater was the loss during the winter; the importance of attending to ventilation at once in the autumn in order to keep the temperature as low as possible in the pit, was proved. By a suitable arrangement of air passages in the bottom of the pit, the temperature was lowered during the first months by 1 to 2°C . (1.8 to 3.6°F .). The lower temperature diminishes the vegetative activity of the roots; consequently the loss of dry matter between autumn and the middle of March was $1\frac{1}{2}$ cwt. per acre less in ventilated than in unventilated pits and 1 cwt. per acre less in ventilated clamps than in unventilated ones. As the value of the dry matter can be estimated at 5 s per cwt., the cost of ventilation is negligible in comparison to the loss that would be caused by neglecting to ventilate the pits. From New Year's day onwards the air passages in the pits were closed, as they had been previously during periods of frost.

When the clamps are made in the second half of October, the temperature in them is higher than when they are made at the beginning of November. The experiments have shown a loss of 16 cwt. of dry matter per acre when the clamps are made in October and not ventilated, as against 8 cwt. per acre when they are made in November. It is therefore advisable to make the clamps as late as possible, and if special weather conditions require the work to be done in October, ventilation becomes a necessity.

The loss of dry matter increases progressively from autumn to the middle of March; if the clamps remain untouched for another month, namely up to the middle of April, the loss during this month is equal to the total loss up to the middle of March. This is due to the fact that during the latter period a high percentage of the swedes rot in the clamp. On uncovering it in the middle of March, the loss during the succeeding month was one-third of what it is when the heap was uncovered in the middle of April. In districts in which mangolds are not grown and swedes must be available after the middle of April, it is useful to uncover the clamps in the middle of March. By measuring the temperature of the clamps, one can have an idea of the amount of the loss being caused. For this object special thermometers are made, by means of which the temperature is taken once every three days during the first month and once a week afterwards. If, in some points, an increase of temperature is noticed, it can be lowered by uncovering that part of the heap.

PLANT DISEASES

DISEASES NOT DUE TO PARASITES OR OF UNKNOWN ORIGIN.

1181. — Further Notes on a Disease of Red Clover in Tuscany (1). — I. BACCARINI, PASQUALE, and BARGAGLI-PETRUCCI, GINO. — II. DEL GUERCIO, GIACOMO. — *Atti della Reale Accademia economica-agraria dei Georgofili di Firenze*, Series 5, Vol. XI, Part 2. pp. 23-96, figs. 1-12, 1 plate; pp. 133-183, figs. 1-39. Florence, 1914.

I. — The researches of Profs. Baccarini and Bargagli-Petrucci on the disease of *Trifolium pratense* known as "incappucciamento", which first appeared in several parts of Tuscany in 1908, have brought to light several factors concerned in the damage, but without definitely deciding which is to be considered as the true cause of the destructive disease in question.

The theory of degeneration of the seed sown in laying down the crop cannot be accepted in this particular case.

The following fungi have been isolated on several occasions from the diseased clover: *Sclerotinia Trifolium*, *S. sclerotiorum*, sterile mycelia of *Dasyscypha* and *Helotium*, *Phoma* sp., *Botrytis cinerea*, *B. vulgaris*, *Torula* sp., *Fusarium metachroum*. Infection experiments have given results which, though not being definite, lead to the conclusion that the fungi, especially *Sclerotinia Trifolium*, *Botrytis cinerea* and *Fusarium metachroum*, cannot be considered as the ultimate causes of the disease.

Four types of bacteria have also been isolated, one of which (type *a*) is more constant and abundant than the others; it is capable of liquefying agar and gelatine and evidently belongs to the genus *Micrococcus*. Inoculations of red clover with this organism have resulted in the production of the chief symptoms of "incappucciamento" in both field and pot cultures. It therefore appears that the ultimate cause of the disease is bacterial infection, probably with the organism of type *a*. Inoculation experiments with this organism tend to show that some lesion, natural or artificial, is necessary for the organism to gain entry. Such lesion may be caused accidentally

(1) See No. 181, B. Feb 1914.

(Ed.)

by mowing, or by the action of certain insects or other animals boring in the stems and roots. Certain eelworms (*Heterodera*) have in fact been recorded on the diseased plants, and also insects belonging to *Apion*, *Hylastes*, *Anthrenus* (?), *Cecidomyia*, *Pteromalus*, etc. Of these, the species of *Cecidomyia* were found to be superficially infected by bacteria, among which type *a* was most abundant. The insects cannot be regarded as the primary cause of the disease, but rather as concomitant pathogenic causes (this may also be said of the fungi) and also disseminating agents of the bacteria, which they carry from plant to plant and inoculate direct into the tissues.

It is not very probable that a deficiency of lime in the soil can have given rise to the disease, nor can it be attributed to soil "sickness".

It is quite probable that the extensive floods of the Elsa in 1907 had established soil conditions favourable to an intense development and a rapid spread of pathogenic organisms previously localised or sporadic. Another hypothesis may also correspond to the facts; it is well known that the metabolism of micro-organisms is liable to variations and extraordinary adaptations, and that slight changes in the conditions of the medium are able to control the elaboration or suppression of definite substances (toxins or hormones). It is therefore by no means impossible that variations of the medium may exercise an influence on certain soil organisms so as to render them capable of a pathogenic action once they have gained an entry into the tissues of the plant. From this hypothesis it would appear that the intensity of the bacterial action would gradually diminish as the soil recovered its normal condition, until it finally disappeared. The progress of this recovery would be facilitated by omitting clover from the rotation and substituting some other forage crop.

II. — Prof. DEL GUERCIO observes that clover attacked by a disease known as "stremenzimento" or "incappucciamento" in the provinces of Florence, Siena, Pisa and Arezzo, showed symptoms which were evidently not due to insect or other animal pests and other symptoms of a different nature caused by worms, molluscs and various arthropods (Crustaceans, Arachnids, Myriapods and Insects).

The following insects are described in detail from the systematic and biological point of view, as pests of clover: *Rhizobacterlesia trifolii* gen. et sp. nov., *Aphis scabrae* sp. nov., *Pemphigus trifolii* sp. nov., *Anthothrips* spp., Cecidomyids, *Apion* (especially *A. virens*), *Hylastinus* or *Hylastes trifolii*, etc.

The writer considers that this disease of clover is similar to that causing the dwarfing of other plants and draws the attention of agriculturists to the necessity of good manuring and rotation.

Though there is no doubt as to the damage caused by *Hylastes* and *Apion*, which is more than that due to Cecidomyids and *Tylenchus devastator*, no precise relation between these pests and micro-organisms can be determined in the present state of the researches. At present it can only be said that they are connected with damage to clover. It will be necessary to observe which action begins first and which is more effective in its results. The writer inclines to the opinion that insects and nematodes initiate the trouble and that subsequent developments of the disease are due to bacteria.

Future investigations should concern the relation between the microbes of the clover and of the soil, nematodes, insects and agricultural operations and the disease of clover, with a view to finding the best means of obtaining normal growth of this crop.

1182 - **Blossom-End Rot of Tomatoes.** — BROOKS, CHARLES, in *Phytopathology*, Vol. IV, No. 5, pp. 345-373, plates XXIV-XXVI, figs. 1-5. Baltimore, Md., October 1914.

Blossom-end rot or point-rot of tomatoes, first reported by Galloway in 1888, is of general occurrence in the United States and has been reported from Canada, Cuba, Australia, New Zealand and various parts of Europe.

The first symptom of the disease is a water-soaked appearance on the blossom portion of the fruit, followed by a spot at the base of the style or half a centimeter or more away from it, or, as is more commonly the case, the whole blossom surface of the fruit may be affected. In this stage the disease very much resembles a bruise. In a few days this dark green water-soaked area becomes black, later involving the whole blossom half of the fruit. The affected tissue collapses and becomes firm and leathery. This collapsing of the diseased tissue, together with the continued development of other parts of the fruit, may produce a definite depression on the blossom half of the fruit, but more often it results in only a flattening of the tomato.

The first effects of the disease are not always superficial. Fruit that appears entirely normal from an external view has often the tissue of several or sometimes all of its placentae collapsed and blackened in the parts nearest the blossom. In some cases this internal condition is accompanied by a very inconspicuous depression of the surface tissue above it or by a small water-soaked area on the surface.

The cause of the disease has been attributed to various organisms, *viz.* *Phytobacter lycopersicum*, *Macrosporium tomato*, *M. Solani*, *Fusarium erubescens*, etc., and many have regarded it as contagious. Recent results seem to show that it is not contagious and that its origin will be found along cultural and physiological lines.

Spraying experiments have generally given negative results, and the majority of authorities attach little importance to this means of control.

Culture experiments have led to the conclusion that neither bacteria, nor fungi, nor enzymes are the cause of this disease. Plants growing under the most favourable conditions are more liable to attack. Continued excessive watering, as well as a drought, may give rise to the disease. Manuring with potash salts in solution increases the disease in proportion to the amount of potash applied, whilst nitrate of soda causes a decrease in the intensity of the disease. These results were not confirmed in the field experiments. Nitrate of soda showed slightly less tendency to increase the disease than sulphate of ammonia or organic fertilisers having an equivalent amount of fertiliser. Heavy applications of horse manure have increased the disease out of all proportion to the increase in vigour of the plants. Plants well supplied with water on a sandy loam have developed less disease than those on a clay loam. Raising the soil temperature of greenhouse plants has increased the disease. The writer is of opinion that the increase in the disease from heavy watering is due to the development of harmful humic and

ammonium compounds and an accompanying decrease in nitrates. Susceptible tissue contains more starch and more oil than normal tissue, and its cell-sap has a higher osmotic value. The protoplasm of the cells from the fruit of the heavily-watered plants is more granular and contains more oil than that of the lightly-watered ones.

BACTERIAL AND FUNGOID DISEASES.

GENERALITIES

1183 - Contributions to the Cryptogamic Flora of Thuringia. — JAAP, OTTO, in *Annales Mycologici*, Vol. XII, No. 4, pp. 423-437. Berlin, 1914.

A systematic list of 300 species of Myxomycetes, Schizomycetes and Eumycetes, collected during the month of July in the years 1906 to 1911, in various parts of Thuringia. Some of them are new to Central Germany and also to Thuringia. One of two species of fungi new to Science is *Entomophthora Jaapiana* Bubák, found on the hemipterous pest *Euacanthus interruptus* L. (fam. Jassidae). The list includes numerous fungi living on the resin of spruce, which are very abundant and well developed, especially in the woods near Oberhof.

1184 - Contribution to the Mycological Flora of Serbia. — RANOJEVIC, N., in *Annales Mycologici*, Vol. XII, No. 4, pp. 393-421, figs. 1-5. Berlin, 1914.

This third contribution contains 271 species of fungi collected chiefly during 1910 and 1911 and partly during 1913, in various parts of Serbia, and on a large number of plants, many of which are cultivated or otherwise of economic value.

Of these, two genera and 19 species are new to Science; large numbers are new to the district and occur on host plants of economic importance.

The following, amongst others, are either new to Science or fresh records for Serbia: *Podosphaera tridactyla*, on leaves of *Prunus Armeniaca*; *Leptosphaeria Tritici* on the leaves of wheat; *Uromyces Tropaeoli* sp. nov. on the living leaves of *Tropaeolum majus*; *Phyllosticta Betae* on the leaves of *Beta vulgaris*; *Cicinobolus Humuli*, parasitic on *Erysiphe Polygoni*, *E. Cichoriacearum* and *Sphaerothoea Humuli* (1); *Septoria Nupharis* sp. nov. on the living leaves of *Nuphar luteum*; *Dilophospora graminis* on the ears and leaves of wheat; *Oidium Tuckeri* on grapes; *O. quercinum* on the leaves of *Quercus pubescens* and *Q. sessiliflora*; *Microbasidium Sorghi* (species representing the new genus *Microbasidium*, instituted by Bubák and Ranojevic, and synonymous with *Fusicladium Sorghi* Pass.), on the living leaves of *Sorghum saccharatum*.

1185 - *Pellicularia Koleroga* injurious to Coffee in Porto-Rico (2). — FAWCETT, G. L., in *Journal of Agricultural Research*, Vol. II, No. 3, pp. 231-233, figs. 1-3, Washington, D. C., 1914.

In 1912 J. Kuijper reported that comparisons of the fungus causing the disease known as "zilverdraadziekte" of coffee in Surinam with

(1) See in this connection, No. 75, B. Jan. 1914.

(Ed.)

(2) See No. 2983, B. Aug.-Sept.-Oct. 1911.

(Ed.)

the fungus causing the so-called leaf-blight of coffee in Porto Rico led to the conclusion that the latter disease is not identical with the descriptions of *Pellicularia Koleroga* Cooke in India, and observed also that it differed from the fungus causing the "candelillo" disease in Venezuela.

However, considering the mistakes in the original descriptions of fungi causing other coffee diseases, and on the other hand the fact that the descriptions correspond sufficiently with the characters of the fungus found in Porto Rico, it seems justifiable to identify this fungus with *P. Koleroga*. Further, the specimens of *P. Koleroga* collected in Mysore, where Cooke first studied the disease, agree perfectly with those found in Porto Rico. It is therefore erroneous to consider the Porto Rico disease as different from that of *P. Koleroga* Cooke.

The researches on the Venezuela disease ("candelillo") support the conclusion of Kniijper that the fungus is distinct from *P. Koleroga*, though allied to it.

It is therefore concluded that *P. Koleroga* exists in the Antilles and the South American continent as well as in India, and that a fungus of similar appearance and causing a disease known as "candelillo" has also been found on the continent. This appears to be the only fungus of this nature found in Venezuela and was wrongly identified as *P. Koleroga* Cooke.

1186 - A Contribution to the Morphology and Life History of *Pestalozzia funerea* Desm. — WENNER, J. J., in *Phytopathology*, Vol. 4, No. 5, pp. 375-384, plate XXVII, figs. 1-7. Baltimore, Md., 1914.

FUNGI

The question of the exact relation of *Pestalozzia funerea* Desm. to the various coniferous hosts on which it has often been recorded in both Europe and America, has for many years been more or less in doubt. Other species of *Pestalozzia* have often been reported as appearing in close relation with diseased plants, yet actual proof of their parasitism is lacking in many cases.

In plate culture, in addition to the typical 4-septate conidia, another kind of spore appeared, resembling a chlamydospore; on germination, this produced a mycelium, the hyphae of which under favourable conditions produced similar chlamydospores, or, on plate and tube cultures, the typical 5-celled conidia.

Inoculation experiments proved conclusively that this species is parasitic under certain conditions, the most important of which appears to be the presence of a great amount of moisture in the air. The fungus is capable of attacking both the leaves and stems of the hosts used in the experiment, viz. Weymouth Pine (*Pinus Strobus* L.), Norway spruce (*Picea Abies* [L.] Karst.), and hemlock (*Tsuga canadensis*). The symptoms of the disease are browning of the leaves, followed in some cases by the appearance of superficial mycelium, the drooping of the young shoots, and the development of the acervuli. The shoots finally die and eventually the whole tree is killed.

As means of control, diseased seedlings should be destroyed as soon as detected, and as a preventive, the ordinary methods of spraying with Bordeaux mixture will probably be effectual.

1187. - *Puccinia Menthae* on *Mentha canadensis* var. *piperascens* in Hungary (1). — GRÓF, BÉL, in *Kísérletiügyi Közlemények*, Vol. XVII, Part. 4, pp. 657-661, 2 figs. Budapest, 1914.

Puccinia Menthae Pers. attacks not only *Mentha arvensis*, *M. crispa* and *M. piperita*, but also *M. canadensis* var. *piperascens*, which has been grown in Hungary for some years.

On this host the aecidium stage develops towards the end of April on the stems of shoots 4 to 6 in. long. It causes a swelling between the first and second node, which results in a curvature of the stem; in some cases the swelling extends over the whole surface of the stem, resulting in twisting. The diseased plants retain green leaves only at the summit, the rest being shrivelled.

Uredospores appear in July and teleutospores at the end of September.

The disease causes a very poor yield owing to the damage to the leaves and the reduced quality of the essence.

Treatment consists in collecting and burning the fallen leaves in autumn and spraying the infected plots with a 2 per cent solution of copper sulphate. The spraying should be repeated in the spring and the crop cut during June before the appearance of the uredospores.

- 1188 - American Gooseberry Mildew in Italy (2). — GREPPI, CARLO, in *Rivista di Patologia vegetale*, Year VII, No. 4, pp. 97-99. Pavia, 1914.

The occurrence of American gooseberry mildew (*Sphaerotheca mors-uvae* [Schwein.] Berk. et Curt.) was recorded on the shoots, leaves and fruits of gooseberries in the middle of May 1914, in a garden at Tromello (prov. of Pavia).

Gooseberries are very little grown in Italy, so that this fungus cannot be of such importance as in other European countries.

- 1189 - *Hypochnus Burnati*, a New Fungus on the Vine in Switzerland. — LENDNER, A., in *Bulletin de la Société botanique de Genève*, 2nd Series, Vol. VI, No. 4, pp. 104-106, 1 fig. Geneva, 1914.

Towards the end of autumn in 1913, several vines growing near to each other in a vineyard at Bossey appeared to be diseased, and peculiar nodular excrescences known to French growers as "broussins" were observed on the stems.

Surrounding these tumours was a white felted growth resembling in its characters the fungus *Aureobasidium Vitis* Viola and Boyer, but actually belonging to a new species of *Hypochnus*, described by the writer as *H. Burnati*.

Analysis of the soil showed a high percentage of lime, which the writer considers is the primary cause of the disease. This new *Hypochnus* is considered to be a secondary parasite, or perhaps a saprophyte.

(1) See also No. 1211, B. Oct. 1913.

(Ed.).

(2) See also No. 183, B. Feb. 1914; No. 953, B. Oct. 1914; and No. 1068, B. Nov. 1914.

(Ed.)

PARASITIC AND OTHER INJURIOUS FLOWERING PLANTS.

1190 - Parasitic Flowering Plants on Para Rubber Trees in Negri Sembilan (F. M. S.).—BROOKS, F. T., in *The Agricultural Bulletin of the Federated Malay States*, Vol. II, No. 7, pp. 165-166. Kuala Lumpur, February 1914.

A considerable number of trees in *Hevea* plantations were noticed to be attacked by two kinds of parasitic flowering plants, not yet determined (1), in a manner similar to that in which mistletoe attacks certain trees in Europe. The parasites possess green leaves, but weaken the host by obtaining supplies of water and mineral salts from the branches, to which they are attached by means of suckers. Several of the rubber trees carried many of these parasitic growths, which were evidently doing considerable damage, the portions of the branches beyond the place of attachment of the parasite being killed in a number of cases.

Their simple entire leaves and prominent position on the branches make the presence of these parasites easy to detect.

The area which was most affected by these parasitic plants consisted almost entirely of trees in poor condition. The foliage was thin and it was probably this circumstance which enabled these parasites to become established, for in a tree possessing a healthy and vigorous leaf canopy the light below the crown would probably be sufficiently reduced to prevent the development of these troublesome plants.

All branches bearing such growths should be cut out, and efforts should be made by manuring to stimulate a more vigorous development of the trees, which should be rested until a better leaf canopy has been developed.

1191 - Experiments on the Food Requirements and Growth of Couch (*Agropyron repens*). BURMESTER, HERMANN (Breslau), in *Fühlings Landwirtschaftliche Zeitung*, Year 63, Part 16, pp. 547-556, 1 fig. Stuttgart, August 15, 1914.

The writer has made a number of experiments with couch-grass (*Agropyron repens*), in completion of those published by Kraus as No. 220 of the *Arbeiten der D. L. G.* (1).

In pot experiments with a light loam soil it was found that pieces of rhizome placed at a depth of 30 cm. (12 in.) did not succeed in reaching the surface, while at 15 cm. (6 in.) the growth made in more than three months was not much less than with pieces at a depth of only 4 cm. (1 ½ in.).

Manurial experiments showed that couch can grow well in very poor soils; when given abundant supplies of nutritive substances it makes a somewhat increased growth, but the increase is by no means proportional to the absorption of these substances, the result being that the plant becomes abnormally rich in the particular nutrients supplied.

In a series of pot experiments in which oats were sown with and without rhizomes of couch, it was found that the yield of grain of the oats was

(1) Probably *Loranthus* spp., which are common parasites on *Hevea*, *Citrus*, and other fruit trees in Malaya. (Ed.)

(1) See No. 1472, B. Oct. 1912. (Ed.)

always distinctly greater when couch was present, while the yield of straw was only slightly reduced; comparison with similar series in which couch was grown alone showed that the oats had greatly hindered the growth of the couch, reducing it to from 5 to 15 per cent. of the normal.

INSECT PESTS.

GENERALITIES

1192. — **New Coccidae in Japan.** — KUWANA, S. I., in *Journal of Entomology and Zoology*, Vol. VI, No. 1, pp. 1-8, plates I-III. Claremont, Cal., 1914.

A systematic description of the following eight new species of *Coccidae* recently recorded:

1) *Xylococcus napiiformis*, on *Quercus serrata*, at Nishigahara, Tokio, and other localities in Japan.

2) *Phenacoccus azaleae*, on the branches and underside of the leaves of *Azalea*; closely allied to *P. pergandei* Ckll.

3) *Eriococcus festucae*, on *Festuca parvigluma*, at Nishigahara, Tokio (1910); closely allied to *E. insignis* Newst. and *E. greeni* Newst.

4) *Pulvinaria citricola*, on *Citrus*, at Okayama, Shizuoka, and on *Diospyros Kaki*, *Hibiscus syriacus*, *Citrus* and other plants at Tokio; closely allied to *P. cellulosa* Green; has one generation per year and is very injurious to *Citrus* at Shizuoka and Okayama.

5) *P. photinae*, on *Photinia illosa* and *Celtis sinensis*, at Nishigahara, Tokio (1912).

6) *P. okitsuensis*, on oranges, at Okitsu, Shizuoka-ken (1912); allied to *P. thespesiae* Green.

7) *P. idesiae* on *Idesia polycarpa* and *Phellodendron amurense*, at Nishigahara, Tokio (1911); near *P. horii* Kuw.

8) *Lecanium (Eulecanium) pseudomagnoliarum*, on *Citrus*, at Tokio and Shizuoka (1911); allied to *Lecanium (Eulecanium) magnoliarum* Ckll. recorded as occurring on *Berberis nepalensis* at Tokio and on the vine at Shizuoka-ken (1912); this is the first record of this species in Japan.

MEANS OF PREVENTION AND CONTROL

1193. — **New Species of Hymenopterous Parasites on *Heliothis armigera* and *Caradrina exigua* in Russian Turkestan.** — KOKUJEV, NIKI A., in *Revue russe d'Entomologie*, 1913, Vol. XIII, No. 3-4, pp. 513-514. Petrograd, 1914.

A systematic description of the following new Hymenoptera: *Haemaphysalis simonovi*, reared from a larva of *Heliothis armigera* Hb. (= *H. obsoleta* F.) (1); *Chelonus caradrinae* and *Microplites rufiventris*, obtained from a larva of *Caradrina exigua* Hb. (= *Laphygma flavimaculata* Harr.).

(1) See also No. 2584, *B. Aug.-Sept.-Oct.* 1911; Nos. 125 and 194, *B. Feb.* 1913; No. 203, *B. March* 1913; No. 627, *B. June* 1913; No. 1117, *B. Sept.* 1913. (Ed.).

1194 - *Dichomeris ianthes*, *Catopsilia crocale* and *Catachrysops pandava*, injurious to Lucerne, Cassias and Cyces in Ceylon. — RUTHERFORD, A., in *The Tropical Agriculturist*, Vol. XLIII, No. 3, pp. 222-224. Colombo, 1914.

In December 1913, the lucerne at the Experiment Station, Peradeniya, was badly attacked by the caterpillar of the Tineid moth, *Dichomeris ianthes* Meyr., which folds the leaflets from below upwards and eats them in patches. A few of the caterpillars had been parasitised by a small Braconid.

In April 1914, several of the Cassias in the Botanic Gardens were defoliated by the caterpillars of the butterfly *Catopsilia crocale* Cramer. The caterpillars have the habit during the heat of the day of climbing restlessly up and down the trunk and congregating between the limbs at the base of the tree. Advantage was taken of this to feed them with branches of Cassia sprayed with arsenate of lead. These cut branches, however, soon wilted in the strong sunlight. A few Chalcids were noticed about the pupae and several of the caterpillars contained Dipterous puparia. A small number were also attacked by a disease which prevented them from pupating. The surrounding bushes and trees were covered with pupae. On the underside of one leaf of *Bryophyllum* sp. fifteen were suspended and on another fourteen. Hundreds were found on the neighbouring *Palmyras*, chiefly on the under-surface of the uncut leaf-bases.

Among the pupae crows and king-crows did good work, though the crows did some damage by breaking off leaves and twigs from the more tender plants. The king-crow was also observed feeding greedily on the caterpillars. A branch of parasitic *Loranthus* growing on one of the Cassias was untouched.

In March 1913, the larvae of *Catachrysops pandava* Horsf. attacked the fronds of *Cycas revoluta* in the Botanic Gardens and stripped them almost to the midrib. There were holes in the midrib at intervals, and the inside was eaten out and the cavity full of a blackish or brownish evil smelling frass.

Larvae and pupae were present, often several in the interior of each midrib. In January 1914, these same caterpillars were feeding on the underside of the fronds, eating through to the upper epidermis. They were attended by ants, *Camponotus* sp.

In May of the same year, the young fronds of *Cycas Rumphii* were attacked; they elongated but were reduced to the midrib, which was dead, withered and bent and hung limp at the apex, giving the tree a very unsightly appearance. In this case also holes had been eaten into the midrib, but there was no extensive mining in the interior, probably because there was sufficient food externally to enable them to complete their growth. The butterflies were actually observed ovipositing on the tender fronds. Many of the eggs were ruptured and a minute, brownish ant was observed actively nibbling at the eggs. An application of arsenate of lead when the larvae are young is recommended for this pest.

1195 - **Animal Pests of Camphor in Ceylon.** — RUTHERFORD, A., in *The Tropical Agriculturist*, Vol. XLII, No. 6, pp. 463-468. Colombo, 1914.

The writer describes the following insect pests of camphor (*Cinnamomum Camphora*) in Ceylon:

1) Thrips (probably *Cryptothrips floridensis* Watson, recently described as injurious to camphor in Florida), not previously recorded in Ceylon. It damages the buds, leaves and branches, causing them to blacken and die. Spraying with tobacco decoction is recommended.

2) Leaf-miner of camphor (*Acrocercops* sp.); the larva mines under the upper epidermis of the young leaves, causing a large blotch; the gallery seems to start from any point, but in most cases the narrowest and presumably the earliest part of the gallery occurs towards the base of the leaf and often on the petiole. The larva is parasitised by a Chalcidid and a Braconid very effectively. Spraying the diseased leaves with tobacco decoction is recommended.

3) The large bagworm (*Clania variegata* Snell.); the case in which the grub lives is made of brownish-white silk surrounded by pieces of stout twigs lying in a horizontal direction. Probably the best way to deal with this pest is to collect and destroy the caterpillars.

4) Bagworm (probably *Amatissa consorta* Templ.); the case is composed of short pieces of twig arranged in a spiral.

5) Larvae of two species of Pyralid (?), one of which is injurious to the buds and the other to the young leaves.

The following insects are also mentioned:

1) *Xyleborus compactus* Richh., occurring also on tea, coffee, and avocado pear; 2) *X. arquatus* Wynne Sampson, which according to Green bores the living branches; 3) *Hyloperthas* sp., recorded by Green on dead or diseased wood; 4) *Lepidiota pinguis*, recorded by Green as feeding on the roots; 5) *Suana concolor*, *Papilio lankeswara*, *P. clytia*, *Attacus atlas*, whose caterpillars are recorded by Green as feeding on the leaves; 6) twig girdler, a Lepidopterous larva which mines in the young twigs, often causing them to wilt and fall over; it bears a marked resemblance to the one found feeding in the buds and referred to above, and it is possible they are one and the same species; 7) *Coptosoma siamicum*, observed feeding on the young shoots; 8) *Aspidiotus* (probably *A. camelliae*) observed on the buds and twigs; 9) *Tetranychus bioculatus*, recorded by Green as occurring in injurious numbers on the upper surface of the leaves; 10) *Brevipalpus obovatus*, recorded by Green; 11) mice, recorded by Green as digging up and devouring seed in the nursery.

1196 - **Outbreak of *Malacosoma fragilis* in California.** — VAN DYKE, EDWIN C. (Dept. of Entomology, University of California, Berkeley, Cal.), in *The Monthly Bulletin of State Commission of Horticulture*, Vol. III, No. 9, pp. 351-354, figs. 90-92. Sacramento, Cal., September 1914.

The genus *Malacosoma* (*Lasiocampidae*) contains several species liable to be injurious to various trees, including apples, in California: they are *M. californica* Pack. (on live oaks and apple), *M. constricta* Stretch (on

black and white oaks), *M. pluvialis* Dyer (on alder and apple) and *M. fragilis* Stretch.

The larvae of the last-named, known as the Great Basin tent caterpillar, were found to be present in enormous numbers during the past summer on species of *Ceanothus* forming brush in the country about Mt. Shasta. They appeared early in June; by the beginning of July, having defoliated the *Ceanothus* bushes, they migrated in vast hosts, attacking the leaves of any trees (except Conifers) they came across: a few reached some apple trees, where they showed themselves as destructive as the other species mentioned above. They also became a great nuisance on the railways, owing to their crushed bodies causing slipping; eventually the engines were fitted with steam jets to blow them off the rails.

Many of the caterpillars were parasitized by various species of Tachinid flies, which, however, made little impression on the numbers; others were parasitized by ichneumon flies, while two species of *Calosoma* and two wasps were preying on them.

1197 — *Phloeotribus scarabaeoides* and *Hylesinus oleiperda*, Beetles injurious to Olives in the Arezzo District, Italy (1). — DE ROSA, ANTONIO, in *Il Coltivatore*, Year 60, No. 28, pp. 301-305, figs. 47-49. Casale Monferrato, 1914.

Phloeotribus scarabaeoides Bern. (*P. oleae* F.) and *Hylesinus oleiperda* F. (fam. *Ipidae.*) bore galleries in olive branches, and are the cause of considerable damage in the country round Arezzo, especially on the hills facing east near Staggiano.

For the control of these insects the writer recommends: a) destruction of the insects during the winter by cutting and burning the diseased branches; b) rational pruning of the trees; c) careful cultivation of the soil; d) complete manuring for the trees.

1198. — *Tetropium gabrieli* var. *crawshayi* on Larch in England. — OSMASTON, B. B., in *Quarterly Journal of Forestry*, Vol. VIII, No. 4, pp. 277-279, figs. London, 1914.

Tetropium gabrieli var. *crawshayi* has recently been reported on larches in several widely separated localities in England, viz. Maer (North Staffordshire), Gerard's Cross (Berkshire) and Hayward's Heath (Sussex).

The insect deposits its eggs in the crevices of the bark of unhealthy trees. The larvae devour the phloem and cambium and even penetrate into the wood before pupating. The tree succumbs quickly and the external layers of the wood, especially the sapwood, show slight damage. Healthy trees do not appear to be attacked. This beetle finds conditions in England favourable to its development, since most larch plantations contain trees 'attacked' by canker (*Dasyscypha calycina* Fuckl.) and by "chermes" (*Chermes laricis* Hartig), and it will not be surprising if it assumes considerable importance in the future.

(1) See also No. 3064, *B.* Aug.-Sept.-Oct. 1911; *B.* Oct. 1913, p. 1561; No. 1312, *B.* Nov. 1913. (Ed.).

Plantations should as far as possible be cleared of all unhealthy or diseased trees. As soon as a tree is attacked by the insect, as indicated by the wilting of the leaves in summer and confirmed by the presence of larvae under the bark, it should be cut down and made into timber or stripped of its bark and the chippings burnt. If the green woodpecker (*Gecinus viridis* L.) is present, the diseased trees may be recognised by the holes in the bark. Dead larches are sometimes found with holes from which the woodpeckers have extracted the grubs, so that only a small number survive to propagate the species.

The following rules are recommended for new plantations: *a*) they should be limited to districts where the larch is known to thrive; *b*) mixed plantations should be made, so as to maintain more natural conditions; *c*) the trees should not be too dense at the time of thinning out as poles.

INTERNATIONAL INSTITUTE OF AGRICULTURE
BUREAU OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

MONTHLY BULLETIN
OF AGRICULTURAL INTELLIGENCE
AND PLANT DISEASES

INDEX 1914



P R E F A C E

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Except in the case of the original articles, which are numbered according to their pages, the numbers of each subject refer to the paragraphs in the *Monthly Bulletin*.

The index consists of three parts : one, of the original articles, one concerned only with Agricultural Intelligence and the last with Plant Diseases.

This volume of contents has been prepared by the redacteur Dr. Giulio Provençal.

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